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The American Academy of Dental Science held its regular monthly meeting December 4, 1889, in the Boston Medical Library Association rooms, President Seabury in the chair.

President Seabury.—Gentlemen, I will now introduce to you Dr. D. W. Fellows, of Portland, Me., who will read a paper on "Fracture of the Jaws."

FRACTURE OF THE JAWS.

BY DR. D. W. FELLOWS, PORTLAND, ME.

Mr. President and Gentlemen,—It is my purpose to-night to consider fracture of the jaws, and particularly fracture of the lower jaw; but I think it not inappropriate to present a brief review of the nature, causes, and diagnosis of fractures, the principles of treatment, and mode of cure.

Fracture is defined as a solution of continuity of the osseous tissue.

Fractures may be simple, compound, comminuted, or impacted. These terms are familiar and need no explanation.

Various diseases, by impairing the structure of the bones, act as predisposing causes of fracture. The most important of these are syphilis, cancerous diseases, osteomalacia, and rickets. But fracture of healthy bones must be always a result of violence, and nearly always of external violence, either direct or indirect, though in numerous instances bones have been broken by muscular contraction.

The reliable symptoms of simple fracture are crepitation, deformity, and preternatural mobility. The peculiar sound caused by rubbing the ends of the broken bones together, known as crepitation, is characteristic of fracture. It may generally be felt as well as heard. This symptom may be obscured by much swelling,

or by great depth of soft tissue, and in impacted fracture it will be absent.

Deformity is general, but not always, present, and it may be a result of the cause which produced the injury or of the action of muscles upon the fragments.

Preternatural mobility is an important symptom of fracture, and is rarely absent unless the fracture be impacted.

The manner of repair in cases of fracture merits some consideration. The first stage, which is a period of preparation, occupies about one week. During this period, in favorable cases, inflammation subsides, the inflammatory products and extravasated blood are absorbed; pain, swelling, and traumatic fever disappear. From the eighth to the seventeenth or twentieth day the parts became red and injected, and covered with a layer of embryonic cells, and towards the end of this period the granulation tissue becomes more and more firm, until, finally, the tissue is converted into bone, forming, in the case of long bones, two layers, one within the medullary canal and the other encircling the ends of the fragments. This is known as the temporary or provisional callus, which is Nature's splint for holding the fragments in position until repair is rendered complete by the deposit of osseous tissue between the broken ends. The temporary callus, it may be stated, is much harder than normal bone. The final stage of repair, after the bone has been united by a sound bony tissue, consists in the absorption of the provisional callus, leaving the bone smooth and in proper condition for continued performance of its function. The whole process may occupy several months, and if the ends of the fragments are not in proper relation to each other the process may be rendered very long and tedious. In union of a fractured lower jaw the temporary callus is found to be much less than in ordinary long bones, the union being direct after the formation of a small encircling band of temporary callus.

Surgeons declare that the treatment of fractures requires a greater amount of ready knowledge, skill, and judgment than any other department of surgery, and that they always approach them with some misgiving.

Surgeons assure me, further, that fractures of the lower jaw are perhaps the most difficult of all fractures to treat successfully, or in such a manner that there shall be no subsequent impairment of function, no discomfort, and no deformity.

The diagnosis of fracture of the lower jaw is usually not difficult. Nearly always crepitation may be found, together with preternatu-

ral mobility, and, I believe, in most cases there will be some deformity, though in a single fracture of the body of the bone it may not be marked; and yet the injury, like many others, may be easily overlooked unless the attention is specially directed to it. In one case that I treated the patient was examined by two physicians at different times and no fracture discovered, although the bone was broken through the body at the right of the symphysis, and through the left ramus. The man was afterwards taken to the Maine General Hospital, and when I saw him crepitation was distinct, and the deformity and mobility of the parts quite pronounced.

The methods that have been employed for reducing and treating fractures of the jaw are almost innumerable. The various forms of bandaging, and external splints, tying the teeth with thread or wire, piercing the fragments and wiring them together, have all proved very troublesome or ineffectual, except in simple cases without displacement of the fragments.

The idea of an interdental splint is far from new, some such appliance having been used by Paré three hundred and fifty years ago. Dr. Hamilton used gutta-percha moulded to the teeth. Plates or splints of metal have also been used, but the peculiar adaptability of vulcanized rubber for the purpose seems to have been first recognized by Dr. Gunning, of New York, who used it nearly thirty years ago (February 12, 1861).

Dr. Bean, of Georgia, used it in the same manner at about the same time or a little later.

The fullest description of the appliance and its application is given by Dr. Gunning in the *New York Medical Journal* (between 1861 and 1867).

For a single, simple fracture of the lower jaw he employed a splint covering the lower teeth and gums, which he kept in place without fastening, the upper teeth resting upon the smooth upper surface, thus allowing free motion of the jaws, and causing but little inconvenience in speaking and eating. When found necessary, however, the splint was fastened by passing two or more screws through the rubber and into holes drilled in the teeth. In all fractures back of the teeth, Dr. Gunning advised a splint fitting over the crowns of the upper teeth as well as the lower, and so fastened by wings and straps that the lower jaw shall be held in a constant relation to the upper.

An apparatus constructed, it would seem, upon correct principles, but too complicated for general use, was devised by Dr. E. A. Clark and Dr. Homer Judd, of St. Louis. This consists of two

separate plates fitted upon the upper and the lower teeth, with spiral springs between, and an elastic sling bandage passing under the jaw strong enough to counterbalance the action of the springs, and thus pressure and counterpressure are exerted upon the jaw to keep the fragments in position, while the whole is movable and under the control of the muscles.

I have recently been called upon to make and adjust the inter-dental splint in two cases, in each of which the lower jaw was broken through the body in the region of the right lateral incisor and through the left ramus.

The first was a merchant of Portland, who, on entering a railway station in a neighboring town, suddenly became faint or dizzy and fell forward, striking the face upon the corner of the door-step, inflicting severe bruises, breaking the lower jaw as described, and completely severing the superior maxillary bones from all connection with the bones of the skull. Just what the line of fracture was in the upper jaw it was impossible to determine; but it was probably through the body of each maxillary bone. This lesion was discovered while preparing to take the impression of the upper jaw, for, on grasping the upper teeth, the motion was quite free, the sensation being similar to that of taking hold of a very ill-fitting set of artificial teeth in the mouth.

The other case was that of a man employed in discharging coal from a vessel. A staging gave way and he fell to the deck.

One arm was broken, severe bruises inflicted, and the crown of the upper left central incisor broken off, in addition to the double fracture of the lower jaw. In each of these cases impressions were taken of the upper and the lower teeth without any attempt to reduce the fracture. Plaster models were made and the model of the lower jaw sawed through at the point of fracture, and adjusted in normal occlusion with that of the upper jaw. The two were then put in an articulator, and separated to a small extent to allow space between the front teeth for taking food. In one case a superior incisor had been previously lost, and in the other, one was broken at the time of the injury. This condition was somewhat convenient, but by no means necessary, in the treatment. After forming the splint in wax to cover the crowns of all the teeth, and to fill the space between the grinding surfaces of the teeth, the whole was removed from the articulator, flasked, packed, and vulcanized.

In finishing, the rubber was cut away in front, so that the upper front teeth were not covered, thus leaving a space. A narrow

opening was also made at each side to allow the parotid saliva to flow into the mouth.

The splint was adjusted to the teeth of the upper jaw, and then the fragments of the lower jaw were brought into position, the teeth inserted in the sockets prepared for them, and the jaws kept closed for a time by means of the Garretson bandage. These were worn, in each case, about six weeks without removing, when the bone was found to be so well united that they were no longer needed.

There are one or two points which I have not touched upon in this paper. One is, the time for inserting the splint. I should say, as soon as possible, but in many cases the swelling would be so great that it would not be well to attempt it for a few days. In the cases I referred to it was inserted in about a week; I think six days. It may be done any time during the preparatory stages, any time within a week, if the circumstances are such that it cannot well be done before, or, in fact, any time before union takes place.

DISCUSSION.

Dr. Fillebrown.—I suggest that matters of detail are oftentimes quite as interesting as principles, and I think that the detail of making the splint would be interesting. Not long since I saw a splint that was made for a patient with a fractured under jaw, and the splint was so large that it allowed nearly the full play of the displacement, so that there was but little gained over the condition which would have existed had there been no splint at all. I inquired into the matter, and I found that tin foil, tolerably thick, was moulded over the teeth of the models and wax added to that for the thickness. Then the models were removed from the pattern and the pattern inserted into the flask, the plaster poured into that, and the splint made from the pattern instead of from the model itself. In consequence of the ill-adjustment of the tin foil in making the pattern the splint was loose, as I remarked, and the displacement of the parts allowed. Now, if I understand Dr. Fellows, he used the models themselves on which to make the splint, and by that means he got a more perfect fit. It has always seemed to me in making splints that it might be reasonable to put a coating of thin tin foil over the teeth of the model, and thereby insure clean work, just about enough enlargement to allow it to go easily on the teeth, and still fit closely enough to prevent displacement of the parts. I would not have thought this worth speaking of had I not seen within the year past the very condition which I have alluded to,

and I know the patient was in that case very much worse off for the splints having been made in that way.

The first case Dr. Fellows reports here to-night, that of the merchant of Portland, I was quite well acquainted with. I did not see the case at the time of the accident, but I have seen the gentleman since, and certainly it was a bad smash-up. He fell a considerable distance,—I understood it was from the steps of the cars, but it seems I am mistaken,—and, striking with full force on the face, both jaws were badly fractured. After the treatment no one would know that so severe an accident had happened to any parts about the face.

Dr. Andrews.—I have had a case that the paper brings to my mind. It was that of a gentleman connected with Harvard University, who, in trying to stop a vicious, runaway horse, received a kick, which broke his lower jaw, about an inch to the left of the symphysis. Besides the fracture there was a loose, V-shaped piece of the jaw containing three teeth, the cuspid and two bicuspids, I think. A few days after the accident the patient was brought to me by his physician to have a splint made to keep the jaw and teeth in place. The patient having a close-cut beard, we thought it best to cover this with a piece of damp cotton cloth, which was tied round the head like a bandage, one object being to keep the jaws together, and make as perfect an articulation with the upper teeth as possible; another, to prevent the modelling composition from clinging to the beard. A piece of sheet tin, such as we make air-chambers of, was then rudely fashioned to the form of the lower jaw, after which modelling composition was heated, placed in this tin form, carried up in place, and allowed to cool about the jaw. Another bandage was then tied outside of this and over the head. We found that the patient could open the mouth to allow an impression to be made of the teeth, after we had tied the loosened teeth to the firm ones. From the impression a splint of vulcanized rubber was made covering the teeth. In three weeks the splint was removed and the jaw found to be united, the articulation being nearly perfect.

Dr. Williams.—I would like to ask Dr. Andrews if he would consider the modelling composition preferable to plaster of Paris?

Dr. Andrews.—In this case it worked quite as well, and was found to be much more convenient. I would say that the plate held the jaw so well in place that the outer splint of impression material was soon removed. The only thing being used on the outside was a simple bandage.

Dr. Smith.—I was called in consultation with a surgeon some time ago to assist him in holding a double fracture of the lower jaw that the surgeons of the Massachusetts General Hospital had treated unsuccessfully with their usual process of wiring teeth together. The case was that of a gentleman who had had been thrown from a carriage, and, like the person whom Dr. Fellows spoke of, he was badly smashed up. Not only was the jaw fractured at the right and left of the symphysis, but the soft parts of the face, especially about the neck, were severely lacerated. The usual procedure of using the interdental splint with a bandage passing under the chin and over the head was prohibited on account of the severe inflammation of the soft parts, producing two sinuses, in which the surgeon had placed tubes for the discharge of pus. I was not called until late in the case, and I found the parts so swollen that it was impossible to take a full impression at once of the jaw. So I took the impression of the lower jaw in three sections by taking modelling compound and using my forefinger as a cup. From these impressions casts were made and put together. A die was then constructed, and on that was struck up a very stiff gold splint going inside of the teeth and over the crowns, but not over the outside. Through this splint, and corresponding to the spaces between the teeth, holes were made, through which passed platinum wire to serve as ligatures in securely fixing the splint in position. Everything being in readiness, the fractures were adjusted, the splint applied and firmly fastened—by means of the platinum ligature—to the teeth. The patient wore the splint some twelve weeks with perfect comfort, and the results were satisfactory to both surgeon and patient.

Dr. Baker.—About two years ago a case of fractured jaw came into my hands. A gentleman from this city was travelling through the West. I do not know the exact details of the injury, but was told that he was riding a bicycle, and fell from it on to the sidewalk. The result was two fractures of the lower jaw, one in the vicinity of the condyle on the left side, the other just back of the mental foramen on the right side. Travelling as he was, he could not, of course, remain in any one place for treatment, and therefore went to several different practitioners for aid. One of the dentists whom he consulted made for him an interdental splint, and it was correctly named, but that was all that there was correct about it. When he came to me, he said he thought he had not been properly treated, and also said, when he reached Chicago, he was in hopes of receiving proper care, and went immediately to Dr. Harland. On learning that he could not remain in Chicago a suitable length of

time, Dr. Harland referred him to me. Upon examination, I found a cartilaginous union on the right side. After removing the splint, the articulation was seen to be fairly good on the left side, while on the right there was a space large enough to place a thumb between the upper and lower teeth in the vicinity of the bicuspids. The right inferior second bicuspid and first molar were badly fractured, and the right superior central badly out of position and loose. The pulps of all these teeth were dead, and there was also a discharging fistula under the chin, with considerable necrosis.

The treatment I pursued was as follows: Knowing that several weeks would elapse before the case could be cured, I advised my patient to procure a room at the hospital, and I called to my assistance a celebrated surgeon. We etherized the patient, after which we found that, by exerting considerable force, we could spring the jaw into its proper position.

After removing the necrosed bone, we placed upon the chin a soft pad of cotton, then over this a plaster splint, and finally passed a linen bandage over the head and under the chin, covering the plaster, and drew it tight enough to hold the jaw in its normal position.

The patient was easily fed through the space made by the fracture of the bicuspid and molar. After about three weeks the bandages were removed, and the jaw was found to keep its position so well that it was unnecessary to use the metal shield which had been prepared. The patient merely wore a simple bandage for a few weeks. I then put the central in place, crowned the lower bicuspid, having previously treated and filled the roots. The last time I saw the patient the adhesion was as good as any one could wish, and there was nothing visible to indicate that he had ever received an injury.

Dr. Pond.—I had a case, a few years ago, which differed from those already mentioned, in that there were no back teeth on either jaw. The six front teeth were in place in the lower jaw, and it fractured on each side just back of the cuspids, the anterior portion of the bone with the teeth being freely movable.

Bandaging proved useless, for, when the front teeth were brought together, the slightest pressure forced the parts out of place; there being nothing to keep the body of the jaw down, it would be lifted upward into the mouth. An impression was obtained by filling the mouth nearly full of soft modelling composition, holding the parts in position with the hands under the jaw, and gently lifting up until the lower front teeth just articulated with the upper ones.

A splint was made of vulcanite, which resembled a partial upper and under plate joined together,—that is, it covered the upper jaw from the cuspids back to the condyles and the corresponding portion of the lower jaw. Sufficient material was cut away to allow for the passage of food. It was placed in the mouth and the parts firmly bandaged, the splint holding the body of the lower jaw in position, and the front teeth performing the same office for the anterior portion.

The parts were held in position perfectly for about a week, when the patient, an ignorant policeman, who was confined to a hospital bed by some severe bruises received in the same row in which his jaw was broken, decided that the jaw was all right, and removed the bandage and splint. The removal was not discovered until the next day, and as the parts were still in position the splint was not replaced. The liquid diet was continued, and when discharged from the hospital, where his other injuries kept him some weeks, his jaw seemed in as good condition as ever.

President Seabury.—The next matter in order is a paper entitled "Rapid Method of Inserting and Finishing Contour Fillings without the Aid of a Matrix," by Dr. Joseph E. Waitt, of Boston.

RAPID METHOD OF INSERTING AND FINISHING CONTOUR FILLINGS WITHOUT THE AID OF A MATRIX.

BY J. E. WAITT, D.M.D.

Gentlemen of the American Academy of Dental Science,—The method that I present to you is not new, neither is it entirely my own; it is a chip from here and a chip from there, and putting them all together, I reached the result of which I will show you a specimen, and tell you how I accomplished it.

For years, science and skill have been coming to that place where each and every department of life is being forced to that point where its work may be accomplished with the greatest ease and in the shortest time. The department which we represent has been among the foremost in devising ways and means for the accomplishment of our daily work with the least inconvenience both to ourselves and our patients. It shall be the aim of this paper to present you, in a few words, a few (possibly new) ideas, and thereby assist you in the labors of the day, and the rapid and satisfactory completion of those large or difficult contour fillings with which we have to deal.

By the use of Dr. Jack's and other matrices very many of the difficult operations in contour filling have become, under the skilful hand, very simple operations; and operations once requiring hours for their completion are now accomplished in minutes.

The impossibility of having the walls of a cavity in full view, and the inconvenience of easily adjusting a matrix, led me to discard all forms of matrices, and look about for a method of quickly reaching the same or a better result. After some years of experimenting with methods, foils, and preparation of cavities, I am pleased to present you a method which you will find to answer the requirements of the case, thereby making operations, formerly long and difficult, so short that they become a pleasure both to the patient and to the operator.

First, space by a separator or tape, to the width of a No. 3 or 4 separating file. Apply the dam in the usual or the following manner: In the case of a right superior second bicuspid, lay the dam over the face, and apply it to the mouth in the position it is to occupy, then with a pencil mark the centre of each tooth from the right superior lateral to and over the first molar. Punch out a hole for each tooth, and then apply the dam, beginning at the lateral and working backwards. Over the molar slip a clamp, or, if close to the second molar, pass a ligature up between, and leave it. Then, with a thin and flat burnisher, turn the dam up on itself around each tooth, and dry with cotton.

The dam applied in this manner obviates the tying of a ligature about each tooth, which is a nerve-trying experience. This method allows greater freedom for working, because the dam is out of the way, and also affords better light. It will be found to answer the purpose for large cervical cavities when properly applied.

Next, prepare the cavity as usual, except do not cut any retaining points, but in their place cut a fine groove across the cervical wall and down the buccal and palatal or lingual walls with a fine burr, and make the opening on the crown surface when possible, slightly dovetailing towards the body of the tooth; then, with a sand-paper disk, smooth the mesial or distal surface, as the case may be.

The gold to be used becomes the next feature, and must be a soft gold, easily moulded under a burnisher. I use the new gold of the Boston Dental Manufacturing Company, ropes No. ½. These may be flattened and made into cylinders with great convenience.

In using soft foil, take No. 4 soft, cut in one-half sheets, and roll to about the size of three-sixteenths of an inch diameter, and

flatten. Each cylinder to be of a length slightly exceeding the depth of the cavity from front to back, and its size in the square to depend upon the width of the cavity and the method of condensation.

I prefer the No. ½ ropes to any other, for the ease with which cylinders may be made from it. For the intermediate layers, of which I will explain later, the Boston Dental Manufacturing Company's No. 4 foil is the form used.

In preparing the cylinders, take a strip full length of soft gold, grasp it with a pair of pliers, and fold over and over until the size wanted is rolled; then condense easily endways, then sideways, and repeat until it is of the desired square.

Never cut a strip in two lengthways to get a short cylinder, but rather fold it upon itself lengthwise, and proceed to roll as in the usual manner. With many of these cylinders of various sizes rolled during leisure-hours, or by an assistant, considerable time may be saved at the moment of greatest strain to yourself and patient.

Now place a floor of these squared cylinders across the bottom of the cavity, allowing the ends to extend slightly over the edge, and with a large round or foot-shaped plugger partially condense this layer; then, with a couple of pieces of No. 4 foil made cohesive and *single thickness*, placed over the partially condensed surface, the whole is thoroughly condensed with a smaller, round plugger, care being taken not to allow the plugger to enter the gold extending over the edge.

When thoroughly condensed, pass a thin, flat burnisher up by the ends, and, with a slight pressure, force them over the edges of the cavity in each direction, making the burnishing carry the gold over the edges, thereby locking it and preventing tearing it out. Increase the pressure upon the burnisher until the ends are well condensed, and shaped to the desired contour.

When this point is reached, place a couple of thin layers of cohesive gold over the whole, and condense well. This is done for the purpose of locking each layer and giving edge-strength to the contour. Burnish this edge well, and then proceed with your second layer of soft cylinders, as you have done with your first, with the exception that the middle cylinders are to be slightly longer than the side ones, to allow for the swell of the contour. Burnish, and proceed as before.

The crown surface can be finished by building up to the desired shape with cohesive gold, which can always be made to unite with

the soft gold, if the first union is made with pieces of a single thickness, well united by mechanical force, and condensed with the soft gold.

Contour fillings, built in this manner, do not need any finishing with a file or sand-paper, as the whole surface is left finished at each stage, and any amount of overlapping gold is burnished off, leaving a clean, smooth edge, and highly polished.

By this method the entire wall edge is constantly in view, and one point is not left for another until the former has been completely *filled* and finished, which alone is enough to commend this method to our careful consideration.

DISCUSSION.

Dr. Andrews.—The subject is so interesting that I wish we had a black-board here, so that Dr. Waitt might demonstrate his method more clearly; and I move you, sir, that we have one hereafter for the use of the members.

Dr. Ames.—I should like to ask Dr. Waitt how long it would take to fill a cavity of the size shown in specimen No. 2. Could you do it in half an hour?

Dr. Waitt.—You could finish the filling in about half an hour. The filling, as far as you see it there, or with one more layer, can be done in about ten or twelve minutes. It will take as long to build that top as it does the three-quarters or seven-eighths of the filling up to that point.

In making these squared pellets, or squared cylinders, I take these ropes, if I want to make a very long cylinder, No. ½, and fold this rope on itself lengthwise, then over and over. If I want to make a large cylinder, I start with full width of rope and fold it on itself and roll it somewhat larger than the cylinder is to be when squared.

Dr. Barker.—So far as I was able to comprehend the doctor, the method he describes is not dissimilar to the one I have been using for several years, and doubtless many others employ it. In regard to the preparation of the cavity, he made a remark that attracted my attention. It was this: "There are no retaining pits used." I apprehend that by far the larger portion of good operators have practically abandoned retaining pits.

The preparation of the doctor's cavity is almost identical with the method that is described in nearly all the standard works on operative dentistry. Without the use of a diagram, or a black-board, I

confess my inability to grasp the minutiæ of the locking and interlocking he describes.

The method consists simply, as I understand it, in laying a mat, a flattened cylinder, or a block of unannealed foil on the floor of the cavity and condensing it. The floor may be thus formed of one block, if it be sufficiently large; place now a flattened cylinder at each border, condensing them laterally against the walls; lay on the bottom one large or three smaller blocks, which, when condensed, expand laterally, thus fastening the side-pieces in position; more blocks may be introduced at the bottom and be treated in the same way. When the cavity is two-thirds or more full, begin to work on cohesive foil. It will readily cohere by the joint effects of molecular and mechanical cohesion, if good serrations are employed; complete the filling with cohesive foil. The burnisher should be employed on the proximal aspect of the unannealed foil during the various steps of the operation.

Dr. E. G. Tucker.—Mr. President and Fellows, I have never used gold foil in any other form but pellets of different sizes, the small, delicate ones in front teeth, large ones in large cavities (grinding surfaces), where great *packing* pressure could be given. By carrying out the filling to the edges with these small pellets and *sharp-pointed* pluggers, you can get as perfect a filling—polished and durable—with No. 4 soft gold and hand pressure as can be made with automatic mallet and hard gold. I have tested this mode of filling fifty-four years, and have used no other to the present day. I will show the Academy four front teeth that I filled for a young man in Harvard College, which were used thirty-six years after being filled, and then were extracted on account of general disease of the sockets of all his teeth, from the effects of which they became loosened. As you will see, the fillings are still in excellent condition and preserved those teeth during that long period.

Dr. Williams.—In regard to mats, or pellets, as they used to be called in Dr. Tucker's early days, this method reminds me of the way his brother and he used to make fillings that made such a reputation for American dentists. I think it was similar to the manner described by Dr. Waitt.

Dr. Briggs.—I do not perfectly understand Dr. Waitt's paper. I wish I could have it explained, as Dr. Andrews suggests, with a black-board. I think he has given us something new, whereas I am quite sure that Dr. Barker has given us something old. His is the ordinary soft filling; but I think that Dr. Waitt's method may have something more in the finishing, perhaps, than any mere

question of using soft or cohesive gold. I do not know, perhaps some of the members understand it better than I do, but it seems to me that the other methods spoken of are very old, and I hope that Dr. Waitt will endeavor to explain his process more fully by the use of a diagram.

Dr. Andrews.—I want to say a few words criticising the shape of the cavity formed by Dr. Waitt. We understand that the shape of the cavity is exaggerated, but you will find the cervical wall to be the weakest part of the whole cavity. We know that if we cut across the tubuli, at the cervical wall, there is dead tissue there, and I should think that the filling could be quite as well made if the floor of the cavity was cut square across or made to slant outward rather than inward.

Dr. Waitt.—I said in the first place that it was an exaggerated case. I expect that each one will use his own judgment. The filling can be practically put in as well on a flat floor as it can on a floor that has a groove cut across it, but where the tissue is comparatively hard, a slight groove can be made. I use the finest inverted cone that the S. S. White Company makes. The filling is a soft gold filling, with the exception that a layer of cohesive gold is placed between the layers of soft foil. The contour is made entirely by burnishing. The pellets are put into the cavity with the ends standing out, somewhat longer than the cavity is deep. It is the length of these out-standing ends that makes the contour. Then again, where each layer is locked, that makes it a little stronger, and you have a hard edge to burnish on to.

Dr. H. A. Baker.—I thought that when Dr. Andrews began to speak he was going to bring up just what I had in my mind, only my exceptions are at the other end of the cavity. What I wish to call attention to is the way in which the essayist forms his grooves. It seems to me that if he brings his grooves clear up through the enamel of the crown, he leaves a sharp corner which necessarily must be very weak, and in my patients' mouths that corner would break off just as sure as the world. To avoid this, I should bring the groove up under the enamel and not cut through it, and leave the corner on a bevel, and protect it by a covering of gold, which would resist the occlusion. Another point in regard to his cylinders: You make a cylinder of rope, and one gets into an elliptical shape, and you cannot avoid it; the result is, your cylinder is thicker in the middle than it is at the ends. Now, in the place of ropes, I would take non-cohesive pellets and flatten them out, lay the flat sides one upon another until you get the desired

thickness; then, bending the ends towards each other, the result is, one gets a cylinder in the cavity like so many leaves in a book, one upon another, with one end against the wall of the cavity, the other against the matrix; and thus you have an even thickness throughout. This should fill the cavity about one-third full, then forming an anchorage above this, and finishing out with cohesive gold, protecting your corners as I described before, and you will have a filling which will stand the test of severe usage.

Dr. Briggs.—As I understand it, it is not so much the shape of the cavity as it is the filling. It may be, it is boring the others, but I wish that Dr. Waitt would give us a *résumé* of his process of putting in the filling.

Dr. Waitt.—Perhaps you are getting too much, gentlemen. I told you in the first place that it was not entirely my own, but a chip from here and a chip from there, and putting these together I got this out of it, and this I can do. Now, the preparation of the cavity or the making of the cylinder is immaterial. I do know that I can take a patient in my chair and fill a cavity in one-quarter of the time that I can do it with cohesive gold, or any other method that I have ever seen. It is my way, and yet it is not my way entirely, because it is a combination of the parts of several other methods.

In the first place, if we look at the end of the cavity from front to back, we see here these squares laid side by side. First, place these squares across the bottom and only partially condense them with a large plugger. Cohesive gold is then placed over this in shreds, as it were, of the thickness of one single sheet at a time, and with a plugger, the serrations of which are sharper than for ordinary condensing, make a thorough mechanical union with the soft gold. I put on perhaps three or four thicknesses of this single foil and carry them right straight down, as hard as I can condense it by hand pressure. Now, I do not condense beyond what is to be the contour of the tooth, for by so doing you are likely to push the plugger through that portion. After the first layer is put in, locked, and condensed, I take a burnisher and carry it up and about the extending ends and form the contour, and burnish away the small amount of overlapping gold. That layer is then practically finished. I claim that after that layer has been put in, you could leave it for weeks, and then take out the filling, and the bottom of your cavity will be perfectly dry.

Dr. Clapp.—I would like to ask Dr. Waitt if he uses a mallet at all?

Dr. Waitt.—When I get clear up to the surface, which would

become the grinding edge, I then use a mallet. I have seen soft gold fillings put in by hand-pressure where the patient has ground and articulated on the filling, and it was not broken. I cannot do it. I would be very happy to learn how to condense soft gold by hand-pressure to stand such a strain.

Dr. Andrews.—May I ask Dr. Waitt the object of the cohesive gold?

Dr. Waitt.—The cohesive gold, as you see it in this layer, extends clear out to what would be the edge of the contour of the tooth. It acts as a face or a resistance to burnish against.

Subject passed.

President Seabury.—Dr. F. G. Eddy will present a new mouth-piece for saliva-ejectors.

Dr. Eddy.—There is a mistake in the announcement on the card that I was to present a *new* mouth-piece. I do not know how it happened. There is nothing new in regard to this mouth-piece. It is simply the old mouth-piece with lengthened shank, and with a stop-cock put a little lower down, so as to be under the control of the patient.

As I was leaving the office to-day, Dr. G. W. Porter, a surgeon of Providence, handed me this box, part of the contents of a dermoid tumor, removed a few days before, and within that, among some hair and some fatty substances, he found these teeth, and also these pieces of bone. Out of sixty ovarian tumors he has found but twelve dermoid cysts. This is the only one in which he has found any teeth. With them he also found the left half of a lower maxillary bone.

Dr. Andrews.—The little stop-cock in Dr. Eddy's ejector is certainly an improvement, but I had hoped that we were going to get something that would not suck in the soft tissues.

President Seabury.—I have an old ejector, the holes of which are on top.

Dr. Briggs.—I like this ejector very much. I would like to ask Dr. Eddy if, in using it in ordinary operations, *débris* would be likely to get into the cracks and stop them up very easily?

Dr. Eddy.—I think not. I use it daily.

Dr. Waitt.—I think the best mouth-piece I ever saw was one shaped something similar to this, but the end of the tube came down nearly to the bottom of a little cylinder made of perforated metal and surrounding it. The saliva can come up in it three-fourths of its length, then pass down and go into the tube. I have used one

of them five years, and I never had any trouble with it. I would like to ask Dr. Eddy, Will these fine slits let thick, stringy saliva pass through them?

Dr. Eddy.—Yes, sir.

Dr. Williams.—I have an impression that this plan of Dr. Eddy's of having slits instead of holes, will be an improvement. There is a chance for a slit to clear itself, while a hole blocks up. There is an objection to the weight of this ejector. I have a short one, not more than five inches at the most. I put in the lightest rubber tubing that I can find that will not collapse by suction, so as to avoid any sense of weight in the mouth. I find the patients feel relieved, and consider it somewhat of a luxury.

Dr. Andrews—One of the advantages of this saliva-ejector is that the patient can hold it in the mouth; but what I wanted to suggest was that the mouth-piece might be difficult to cleanse. Any one of you who has tried to clean a saliva-ejector must have been surprised at the amount of filth that can get into an instrument of this kind.

Dr. Codman.—I have noticed among practitioners a growing tendency to make dental operations complicated. I think that has been so very largely in the use of the saliva-pump. I think, in a great many cases, it is entirely unnecessary, and should be dispensed with. The drawing out of a person's system of a pint to a quart of saliva must certainly be very exhausting, and this is done in many cases where the saliva-pump is not needed at all. I don't think I have used one in six months, for I find by a proper adjustment of the rubber dam with ligatures my patients get along much easier than they would by the use of the saliva-pump.

Dr. Meriam.—I should like to present, Mr. President, as chair man of the Executive Committee of the Massachusetts Dental Society, a cordial invitation to the Academy to our next meeting, to be held on Thursday next. In addition to our usual programme we shall have a small exhibit, not as extensive as last summer. The annual address will be delivered by Rev. Alexander McKenzie, D.D., secretary of the Board of Overseers of Harvard University. The address will be given at 4.30 o'clock in the afternoon, and we hope there will be a large attendance. It will be given in the large hall of the Young Men's Christian Association. We have sent an invitation to the faculty and students of the Harvard Dental School, and also to the faculty and students of the Boston Dental College, and we trust that the attendance will be large, to do justice to our orator.

Dr. Fillebrown.—Mr. President, I move the invitation be accepted and placed on file by this society.

Dr. Waitt exhibited a nitrous oxide light for photo-microscopic purposes with the following description:

The principle is old in that it is a combination of the Knapp blow-pipe simply adapted to a burner which carries a piece of lime. It is after the principle of the oxyhydrogen light, with the exception that we use ordinary illuminating gas and nitrous oxide gas. By this I get, as you see, a very powerful white light. In my first experiments it would spit and sputter, but I finally found that the trouble was in getting the gas out of the cylinder. It would persist in freezing. If I blow off about twenty-five gallons, or use a seventy-five- or fifty-gallon cylinder, I get the result which you see here. A light, as Dr. Andrews knows, for photographic purposes, needs to be an intense white light. This light can be used for the projection of pictures on a screen, and for a picture up to twelve or fifteen feet in diameter it is perfect. In a course of lectures by Dr. Dearborn I illuminated a circle of twelve feet diameter, and he said the pictures were fully as well illuminated as if they were shown by his regular operator with the oxyhydrogen light. The plates were the ordinary three and one-fourth by four.

In the illuminating of stereopticon pictures all that is required is a bright spot or line of light; in other words, the whole thing to be reached is to get the most intense white light into the smallest possible spot. After I once get this light in this way, and the cylinder of gas down to where it will blow readily, we can regulate the light by a stop-cock in this cylinder.

ADDRESS OF PROFESSOR F. W. PUTNAM BEFORE THE AMERICAN ACADEMY OF DENTAL SCIENCE AT THE PEABODY MUSEUM OF ARCHÆOLOGY AND ETHNOLOGY, CAMBRIDGE, JANUARY 8, 1890.

Mr. President and Gentlemen,—The principal object I have to-night is to call your attention to the importance of our collection of crania in a study of the diseases which affected the teeth and bones of the mouth of the people living in America at the time of, and prior to, the first occupation by the Europeans.

In our large collection, containing several hundred crania from various parts of the world, and, probably, over fifteen hundred from America, there is considerable valuable material for the study of various diseased conditions of the mouth, singular modifications of the palate, and anomalies in the position and shape of the teeth. I might have brought hundreds of crania to the lecture-room, all of which would have been interesting from your professional point of view, but I have limited myself to the few on the table, simply as examples of what you may expect to find if any of you wish to make a study of the whole collection.

Here are twenty skulls from the Santa Barbara Islands, off the coast of Southern California. In 1542 the people of these islands and from the main land came into contact with the Spaniards; and after the establishment of the missions on the coast they rapidly deteriorated, and finally succumbed to the changed conditions of life forced upon them by the whites, and to the vices which the contact brought about.

While many of the burials on these islands were long before white contact, others were after that period, as shown by the various objects of European work found in the graves. Hence we have here the opportunity of tracing the effect of the change of life which came to the people, and some of the marked cases of diseased conditions may be due to this change. Still it is evident that the primitive life of the people and their peculiar food had much to do with the singular wearing away of the teeth which is noticeable in this series. Starting with this skull, where every tooth is sound, you will notice the flat crowns of all, and the perfect occlusion. I think you have seldom seen a nearer approach to the movements of a jaw of a ruminant in a human subject than must have been the case in this man. Passing from this skull down the series as

here arranged, you will notice the gradual wearing away of the teeth caused by the grinding of hard substances; this wear was probably increased by the sand mixed with the food, derived, partly, from pounding the seeds and acorns—which probably formed a constant diet—in stone mortars. As a result of this grinding process we can trace all the abscesses, and terrible suffering which the people must have endured, as shown in these jaws. Finally, nature gave relief to those who survived the suffering, by throwing off the roots of the teeth and closing the alveoli, as shown to be the case in so many of the crania, where, even before great age, the maxillaries were reduced to thin plates of bone.

So much has been said about syphilis in America, and that foul disease has been so often considered as of American origin, and responsible for many of the conditions met with in crania such as these, that I shall take this opportunity to say that, so far as can be determined by a study of the skeletons which we have, I consider there is not the slightest evidence of the occurrence of the disease in America until after contact with the whites. These skeletons have been studied by specialists, but in no case has any trace of the disease been found in skeletons antedating white contact. It is but just, therefore, to relieve our native American peoples from this foul imputation.

For comparison with the California crania I have chosen this skull of a Massachusetts Indian. This skull is from Winthrop, and from a burial-place which I have reasons for believing was not used after the first settlement of the whites at that place, at least two hundred and fifty years ago. This skull is of the same shape and character as the Californians, but you will notice that while this has a bad abscess in the under jaw, the teeth are not ground down in the same way as in the California crania. Here we probably have the evidence of a different diet and one containing not quite so much sand and gritty material.

In this series of skulls from the Sandwich Islands is probably the evidence of another kind of diet,—flesh and fruit. In the skulls the teeth are all sound and sharp and no sign of grinding or wear. Then, again, the jaws and palate are more like those of the white race; and, as you will notice, they have not the constant width of the Californians, but vary very much in shape.

Professor Putnam then called attention to a number of anomalies in the dentition of the several skulls on another table. They were from Peru and from the mounds of Ohio. In several of the Peruvian skulls the lateral growth of the third molar was pointed

out, and in those from Ohio he referred to the probable later development of this tooth and its non-development in some instances.

He also pointed out several instances of supernumerary teeth, and one skull where the left canine had turned laterally and posteriorly and penetrated the maxillary under the anterior edge of the malar bone.

As showing the resistance of enamel to natural decay, a mass of clay was shown which contained the enamel shells of a full set of teeth, while the skull and all other portions of the skeleton had been reduced to fine particles, or bone dust. This was from a very old burial near the Serpent Mound in Ohio. He had in several other instances found the enamel of the teeth the last part of the skeleton to decay. In some instances, however, he had found fragments of bones, even the spongy portions of the humerus, where there was no trace of other bones or of the enamel of the teeth. He could not say, therefore, that the enamel was always the last to decay, but thought this was likely to be the case with the skeletons of children.

DISCUSSION.

President Seabury.—Gentlemen, we have all listened with great pleasure to this very interesting lecture of Professor Putnam. The matter is open for discussion or questions. I presume you have many questions which you would like to ask and which Professor Putnam will be glad to answer.

Dr. Fillebrown.—I would like to ask more particularly as to the age of these California skulls,—were they young people or adults? Has it been demonstrated that they when young had cusps that were equally prominent with other races?

Professor Putman.—On that point you will have to put the facts together and draw your own conclusions. You will find that the teeth are very large. Now, it is beyond the power of the average investigator to get at the exact age of the individuals, but judging by the sutures,—which we go by in determining the age more than by any development of the teeth, because we cannot assume the protrusion of the teeth in other races at the same years as in the white race,—all the skulls on the table are fully adult and many of advanced age.

Dr. Fillebrown.—In looking over the skulls of these Californians, I should say that the cusps of the teeth of this people were less prominent than in the Sandwich Islanders, and that the occlusion of the teeth has more nearly the characteristic of the ruminant,

and that the overhanging of the upper jaw is less pronounced than in the races of the present day. To-day we consider it an exception where the teeth occlude all round; but here the indications are that it was a race characteristic.

Professor Putnam.—I think it will be found to be common to many peoples other than the white race.

Dr. Fillebrown.—There is one more question which I should like to ask Professor Putnam, and that is, whether or not there are some indications by which you can determine the sex? The appearance of that Roman skull seems to indicate its being the skull of a female. In the first place, the bones seem to me to be thinner, and secondly, we see smaller teeth and more delicate ones in every way, and especially I notice the characteristic of the lower jaw that seemed to indicate to me that it was the jaw of a female.

Professor Putnam.—Taking all the male and female characteristics into consideration, I should regard the skull in question as that of a woman. I suppose it is hardly fair to compare a Roman lady with a California Indian, but we will do so in this case for the sake of contrasting her skull with this skull, which has all the male characteristics so strongly marked that you can see the differences at once.

Dr. Fillebrown.—I trust Professor Putnam will not consider that we are boring him, but I am so much interested in the comparison of the skulls here, and as it is a line of observation that I have not been familiar with before,—my own observations having been confined to the upper jaw,—that it would please me very much, and I believe others also, if he would show us the comparison of the sexes more thoroughly and explain what are the distinctive characters of the males and females.

In reply, Professor Putnam pointed out many differences which are considered as sexual, and stated that the differences between the sexes were not so marked among savage peoples as among civilized.

Dr. Fillebrown.—I have just one more thought to present, and that is a conclusion I received from the hint that Professor Putnam gave us to-night. I have thought of this before, but it has more clearly than ever appeared to me to-night. It has been claimed that a typical set contains forty-four teeth. The transition from the human incisor to the cuspid, and from the cuspid to the first bicuspid, also from the second bicuspid to the first molar, is very marked. I understand the theory is that one incisor and a first and fourth bicuspid have been lost in the development of the human type. Professor Putnam's observations seem to indicate that when the more

perfect man shall arrive, a few thousand years hence, the third molar will be obliterated.

Dr. Andrews.—I would say that a former patient of mine had the fourth molar, thirty-six teeth in all. They did not cause any inconvenience, nor have the appearance of an anomaly, but they were as beautiful a set of natural teeth as I ever saw.

Dr. Fillebrown.—I have a model of a mouth that I took where the patient had three well-developed bicuspids.

Dr. Andrews.—On both sides of the jaw, upper and under?

Dr. Fillebrown.—I do not remember about the under jaw, but on both sides of the upper jaw there were three fully developed bicuspids.

Dr. Andrews.—Mr. President, I move that the privilege of the floor be allowed to all those present.

The President.—Without the formality of a vote, I know that the privilege will be accorded to any one wishing to speak. We shall be happy to hear from any gentleman present.

Dr. Codman.—There is one thing it seems to me has been brought out this evening, and that is, that similar causes bring about similar results. Here are the skulls of a race of people who lived in a certain way, and their teeth are worn down accordingly. If they had lived in another way, if they had another diet and other habits, the development of the wear of the teeth would have been different. Diet has a very strong influence in the wear of the teeth.

Dr. Taft.—One thing that I noticed, especially in the teeth of the lower jaw that were passed around, was the peculiar wearing away from the lingual to the buccal side almost down to the gums. I would like to ask Professor Putnam whether that comes so much from the diet as it does from the occlusion, which so closely resembles that of the ruminants?

Professor Putnam.—I could not say; it does exist throughout all the skulls of these Californians.

Dr. Taft.—You spoke particularly of their diet consisting of acorns and roots.

Professor Putnam.—Yes; it must certainly have had some effect.

Dr. Fillebrown.—There is another thought that occurs to me in regard to the appearance of these teeth. If any one takes food into their mouth upon the right side, they will be sure to move the jaw towards the left, and *vice versa.* Consequently the bite comes upon the inner cusps of the upper teeth, and the outer cusps of the under teeth. That will account for the wear of all the teeth of these skulls.

The President.—If there is nothing more to say, we will pass the subject.

Dr. Fillebrown.—Mr. President, I think at this time it would be very appropriate, and I move you, sir, that the hearty thanks of this society be tendered to Professor Putnam for his very interesting lecture before the society.

Professor Putnam.—Mr. President, in accepting this vote of thanks, I wish to say that this museum was founded for the study of anthropology; that it has been the work of years of earnest endeavor to make collections which will give the means of studying man in all his various conditions and habits. We wish to have this museum made use of, and I hope that you will avail yourselves of the facilities it offers.

THE American Academy of Dental Science held its regular monthly meeting February 5, 1890, in the Boston Medical Library Association rooms, President Seabury in the chair. A paper on "Advantages of Using Celluloid as a Base for Prosthetic Dentures" was read by Frederick W. Seabury, Providence, R. I., as follows:

ADVANTAGES OF USING CELLULOID AS A BASE FOR PROSTHETIC DENTURES.

BY FREDERICK W. SEABURY, PROVIDENCE, R. I.

MR. PRESIDENT AND GENTLEMEN,—I shall take pleasure this evening in telling you a few of the good points that I know about celluloid dentures; and get in a few clips at our old enemy, ignorance,—politely called conservatism. I have been wrestling with this subject for the past nine years, with varying success. I guess that I have been on top half the time. Why the Celluloid Manufacturing Company, of all people, should have made machines and published instructions which, when used and followed, reduced celluloid to a soft, porous, colorless mass is beyond my comprehension, but that is exactly what they did. A dentist who could discover the few good points on working celluloid which are buried in the thirty-six pages of matter on that subject in Richardson's "Mechanical Dentistry," fourth edition, would have no use for them when found. This observation applies with equal force to dental literature in general.

The amount of reliable data on all subjects connected with dentistry, to be found distributed in fragments and buried in dental journals, books, and essays, will astound any one who will take the trouble to investigate. What dentistry most needs to-day is some one capable of condensing and amalgamating facts already recorded. Celluloid as a base for artificial teeth came into general use about 1871, and in 1876 we replaced the last plates we had made with rubber free of charge. There are a few dentists who have worked celluloid successfully ever since it was introduced, but the large majority of dentists discarded it entirely as soon as the Goodyear rubber patent expired, in 1881. The advent of the New Mode Heater and celluloid dentures made in it at the American Dental Association meeting, held in Boston August 3, 1880, revived interest in celluloid. Of course I ordered a New Mode Heater, which I received the following spring. I worked a month day and night without producing a celluloid plate. I did make a

black rubber plate with celluloid gum. Then I started for New York City to see the inventor, John S. Campbell. He agreed to come to Providence and teach me what he knew about celluloid for one hundred dollars and expenses, which amounted to another hundred dollars. I have four plates here, two black rubber with celluloid gum, and two celluloid. Campbell made one of each, and I made the others at that time; my celluloid plate has the vitreous surface, his was polished. I then worked a month before I produced another perfect celluloid plate, after that the percentage of perfect plates increased steadily.

I have labored constantly to reduce the process to a mechanical certainty for every dentist who may wish to work celluloid, and I believe that I have succeeded. The greatest difficulty has been to discover the length of time required to heat the plaster investment up to 315° F. I probably burned and exploded one hundred celluloid blanks, and invested one hundred days' work before that was accomplished. I invented the inclined guide-pin to obviate the breaking of the plaster investment, over the projecting alveolar ridge in front, when opening the flask and when moulding. I made a flask with removable guide-pins to supply the need of a lateral movement which was found necessary when opening the flask. The dovetail lock was invented because plates were liable to burn or become porous if left in the heater after moulding. I journeyed to Philadelphia to inquire if the form of the celluloid blanks could be changed to resemble dental plates and the color varied. The S. S. White Dental Manufacturing Company, which desired the change as much as I did, gave me a letter of introduction to the president of the Celluloid Manufacturing Company, upon whom I waited in Newark, N. J. He told me that the plates could be made any and every shape and color desired, but as they had one hundred thousand plates on hand they did not intend to make any more. I then visited the Zylonite Company, in New York City. I was cordially received, and they regretted very much that we had not met before, for they had hired the same bungling dentist whom the Celluloid Company had employed, and of course they had a large stock of Zylonite blanks which they could not sell. Blanks such as I wanted could be made with one-half of the material, and they felt badly when they realized the mistake they had made.

Nearly all of the failures to make celluloid dentures can be attributed to the form of the blanks. The size, shape, and unequal absorption of the alveolar process, in nearly all cases, centres the whole pressure, when closing the flasks, on the teeth where least

material is required, thereby cracking the teeth and investment. Celluloid is so unyielding that the blank before moulding must be formed so as to exert an equal pressure on each tooth at the same time. As no outlet can be made for the surplus celluloid in the centre or roof of the plate, blanks must be reduced to the thickness required by the denture when finished, otherwise the flask cannot be closed. I now first mould an exact duplicate of the plate desired, so when moulding the second time with the teeth in place the pressure will be equally distributed.

The next point is the amount of pressure required to produce a dense tough plate. After locking the flask, remove it from the press as quickly as possible and place it in a large bench vice, close as tight as possible, and leave it there to become cold. You can easily understand that I was not long in crushing a half-bushel of cast-iron flasks; then I experimented with malleable-iron flasks to the tune of four hundred dollars,—they proved unsatisfactory; brass was too soft, bell metal too hard and brittle. My flasks are now made of bronze a little softer than bell metal.

To make a perfect plate requires a perfect flask. The vitreous surface is dependent on a temperature of not less than 300° when moulding, and contact of the celluloid with metal at that time. The artistic possibilities of celluloid and plain teeth are too evident to need comment.

The advantages of celluloid as a base plate are:

1. The part of the plate covering the hard palate is $\frac{1}{32}$ of an inch or less thick, and the labial portion only thick enough to restore the contour of the face, which with plain teeth makes probably the lightest denture in use.

2. It is tough and rigid. I have never seen a broken plate.

3. The vitreous surface protects the plate from the fluids of the mouth, so they are cleaner even than continuous-gum work.

4. Practically the perfect fit of the celluloid plate counterbalances the conductivity of metal plate so far as inflammation is concerned.

5. In color the carved stippled surface, after the tin-foil is stripped off, resembles mucous membrane more than any material now in use.

6. They are easily adjusted to fit inflamed tissues by dipping in boiling water.

7. It is easily repaired without changing the fit.

8. Celluloid moulded by dry heat does not deteriorate or change color.

DISCUSSION.

President Seabury.—The subject is now open for discussion.

Dr. Ham.—Mr. President, I cannot say that I have investigated this matter, or proved it so thoroughly as Dr. Seabury, as I have not given it the time nor spent the money on it that he has, but I can say that I have used celluloid since 1871, and have prepared my cases in both ways,—with the metal dies and by the old method. I think that the method of making it between the metal dies is very much preferable to the old method, as it produces much better results. The old method in many instances left the case somewhat porous, and it would absorb moisture and discolor. But taking it all in all, in the use of both methods, I have never had to make over any more plates with celluloid than I have with rubber, and those plates that I have seen in after years look very well. I first begun to use celluloid in temporary cases, but I found that my patients never came back. I never got any permanent work to do, for the celluloid worked so well that they had no desire to change. I have a patient who is wearing a temporary celluloid plate which I made in 1871, and five or six years ago, while I was doing some other work, the patient was talking of having a permanent set, but I have not had the opportunity to make it yet. It makes a very durable and light denture, and I think second to none when taking into consideration its cost and the artistic result that can be produced in all cases. You can make just as thin a plate over the gum as you choose, and still it will look very natural and it will be very tough and very durable. Now, in order to produce the same effect with block teeth it would be necessary to grind them so much that they would be very thin and fragile. There is another thing I consider of very great value, and that is, the adaptability of the material to the mouth.

I never have to depress the arch of the plate to make it fit the roof of the mouth, as I have frequently to do with rubber. Celluloid, if exposed to a dry atmosphere, will warp when made in the old way, but with the new process the tendency to come together does not follow; the plate will remain very much as when taken from the metal die no matter how long the exposure, and I have brought here to-night a case which was made for a patient six months ago. The arch was high and it was very hard to remove the case from the die. I do not know whether these three front teeth were broken in removing the plate from the die or not, and my workman did not know, but they were broken off in some way, and so the

case was worthless, and I thought I would bring it here, it being a good one to illustrate this matter. You can see that it was a difficult case, on account of the overhanging of the mouth. The plate has been off the die now since it was made, though I have put it on there once to test it. The case was a difficult one to handle, and it would be considered such were it a gold plate, but when I replaced it upon the die it fitted as perfectly as the day it was made, and I think it would now go into the patient's mouth without any trouble. And then the color; even if it does not retain it for any great length of time, it cannot be gainsaid that it is superior to rubber in this respect, as it is certainly very flesh-like. I am not able to compare it with the continuous-gum work, as I have never used any in my practice. My experience in repairing it deterred me from ever introducing it in my practice.

The color of celluloid is good, the texture is not as dense as rubber, but it is fibrous and exceedingly tough. I remember a partial case of about six teeth, scattered around in various portions of the mouth, which for some reason did not answer. I have repeatedly put my whole weight on that partial set without breaking the plate. I think if I have done so once, I have done so a hundred times. I did finally succeed in bending it with about two hundred pounds pressure.

And then the artistic effect that can be produced with this material, I think, is a very desirable point. The teeth can be arranged to your liking, with the assurance that a satisfactory result will follow in the completed plate. If you employ blocks, the arrangement is too regular,—too mechanical, the teeth are too nice. I could not with carved blocks seem to adapt each case to the individual, but now with these celluloid plates, and being able to use the plain teeth, it is a very easy matter to move a tooth in any direction, and you may be sure it will be just where you placed it, if everything is well done in the laboratory.

Now, there is another point. Dr. Seabury tells me that he does not stipple the gum, because the smooth surface can be kept cleaner and neater than the stippled gum. I have seen but very few of them, however, but what looked as good as new and had nothing upon them but what could be easily removed with a common tooth-brush, a little prepared chalk, or something of that kind.

On the whole, I am persuaded that celluloid is about as good a material as we have to use in our laboratories.

Dr. Eddy.—I have used celluloid for some years, and, being a competitor of Dr. Seabury, I have had opportunity to see a great

many celluloid plates which he has made, and I know what he has said is true. But plates made by the old method, not having a vitrified surface, do not hold their color, and are not as durable as those made by Dr. Seabury.

Dr. Chandler.—I would like to ask Dr. Seabury if he uses a metal die or a hardened plaster cast?

Dr. Seabury.—A metal die, always.

Dr. Fillebrown.—What metal do you use?

Dr. Seabury.—I use tin mostly.

Dr. Chandler.—Did you find any trouble in the use of tin in filling the mould? You cannot make a sharp casting with it.

Dr. Seabury.—I have not experienced any trouble of that kind. We mould them in sand the same as we do zinc.

Dr. Fillebrown.—I have been much impressed with the remarks of Dr. Seabury, and am much more interested in the subject than I expected to be. The excellence of the work shown here is very marked. I used celluloid considerably in former years, but returned to the use of rubber, as that seemed to serve me better. I used tin dies for the palatal and lingual surfaces of the plates and got a very fine hard finish, but I did not coat the labial gum surface with tin as has since been done, and probably that was the great reason why I laid celluloid aside. There is one other point brought out in this discussion worthy of consideration,—that is, the merits of plain teeth over gum sections for artificial substitutes for natural teeth. I consider them very much superior in every way. For nearly twenty years I have used scarcely a set of gum teeth unless by command of my patient. I agree with Dr. Ham that plain teeth are best because more easily arranged in the mouth according to the artistic requirements of the case. Or, to state it stronger, plain teeth can be arranged artistically, while gum teeth cannot, but must submit to predestined rigidity. As each plain tooth can be moved separately, the personality of the patient will assert itself, and an individuality will be obtained not possible with gum sections. At one time I was in the habit of carving models for teeth in wax, arranging them in the mouth and having gum sets carved for cases. But though the carved sets were far better than the moulded gum sections, they all came back with a monotonous sameness, very objectionable. The plain teeth with pink rubber for gum afford myself and my patients great satisfaction. By using teeth a little longer than natural, but not enough so as to be noticeable, the gum will show but little if any, and the case will look a thousand times better than if made with the rigid sets of gum teeth.

Dr. Banfield.—Mr. President, I had occasion to make a set of teeth a few days ago where the upper jaw was very prominent, and finding that if gum teeth were used the lip would be thrown too far out, I decided to use celluloid made by the Seabury process. It was particularly advantageous to use celluloid in this case, because the labial surface of the plate required to be very thin, and the use of celluloid assisted in arranging the teeth to look more natural. When the plate was finished the material looked good and firm and I was well pleased with it.

Dr. Codman.—I would like to ask Dr. Seabury what blanks he uses?

Dr. Seabury.—They are all White's.

Dr. Ham.—If you remember, soon after the introduction of this material, the works of the Celluloid Company were destroyed by fire, and the stock they had on hand was either burned up or ruined. Then there was quite a demand for it, and the company was induced to immediately enter upon the manufacture of it again, and the consequence was they placed upon the market a material that had not been thoroughly seasoned. What we are getting now is very much better.

Dr. Williams.—I wish to ask Dr. Seabury in regard to the non-warping qualities,—whether it is liable to warp?

Dr. Seabury.—This set of teeth has been lying on the bench and has been exhibited for nine years. There has been no shrinkage or warping. They are moulded at such a high degree of heat, 315° F., that the tendency to warp is overcome.

Dr. Andrews.—I would like to ask Dr. Seabury if the blanks are any better now than they were before in regard to the shape?

Dr. Seabury.—They have not been changed. Celluloid has almost gone out of use nowadays, and they had such a large stock of blanks left on their hands that they refused to make new dies. They realized that they were two or three times as thick as they need to have been, and of course it would have been a great saving to them if they had been made the right thickness. As they are, they have to be scraped to the required thickness.

Dr. Fillebrown.—Do you make new moulds each time?

Dr. Seabury.—We mould a plate every time. First scrape the roof,—scrape it down to the thickness you want it,—then mould it, and then it is ready to put the teeth on, all of which could have been avoided if the blanks had been made the right shape.

Dr. Banfield.—There was one thing which I wanted to ask Dr. Seabury, and that is, if he had seen any plates that had been worn for a year or two and then laid aside?

Dr. F. N. Seabury.—I can answer that question. About a year or so ago a lady came to our office who had been wearing a celluloid plate for five or six years. The plate was all right in every respect, but she wanted to have a gold one made. We have that plate now, and it is just as perfect as it was then.

Dr. Banfield.—Have you ever tried it in the mouth?

Dr. F. N. Seabury.—We have never had the opportunity, but Dr. Ham's demonstration is pretty conclusive on that matter. I think it does not change.

Dr. Baker.—I should like to ask Dr. Seabury if he has ever had any difficulty in removing the plate from the metal die?

Dr. Seabury.—No, sir. You can do that every time by immersing the plate with the tin die in a basin of cold water; then hold the basin over a gas-burner, and the flame striking the bottom of the basin will heat the die; before the water boils, the plate can be easily removed. In this machine (the Seabury celluloid machine) a celluloid press and heater are reduced to the simplest form. The advantage of this little press is that the operator has perfect control of the case through each stage of the process. I can tell by touching my finger to the tin die how hot the plaster is. It is the heat from the plaster that moulds the celluloid. The flask should be put in bottom side up, turn the gas on, and leave it in there an hour and a quarter at a temperature of 320° F. Then mould. The flask will close in from four to five minutes. Then remove it from the press as soon as possible, so that it will not burn or become porous. This can be done very readily. The flask when it is heated up to that degree of heat is pretty hard to handle, but the door is large enough so that you can get the flask in and out quickly without burning yourself. I have not had an imperfect case since I have used the heater. I am more sure of the product than I would be with rubber.

Dr. Baker.—Do you use the metal always?

Dr. Seabury.—The metal must come in contact with the celluloid or you don't get a finished surface. You get the same effect by covering your plaster with tin foil. The only way you can tell how hot your investment is, is by the siss of the tin die.

Dr. Chandler.—Tin is a very soft metal, and when it is heated to something like 300°, it will take the impression of almost anything. In the manufacture of vulcanite plates, it will take every impression of the mould.

Dr. Seabury.—I have never seen more than one or two softened in nine years. In the case of a very narrow alveolar ridge, I would not trust the tin, I would use bronze.

Dr. Fillebrown.—How would Babbitt metal do?

Dr. Seabury.—I don't know. I have never used it.

Dr. Fillebrown.—I think that Babbitt metal melts at a lower degree than tin.

Dr. Chandler.—Oh, no; between tin and zinc.

Dr. Williams.—I would like to ask Dr. Seabury why he does not use zinc?

Dr. Seabury.—I do use it occasionally, but it is more apt to shrink. We mould these tin dies very thin, and it is hard work to get a suitable mould from zinc. The shrinkage takes place right in the centre of the roof and you get a hole there.

Dr. Fillebrown.—I would like to ask if there is considerable celluloid used?

Dr. Seabury.—I should judge there were about half a dozen dentists who use it in New England, but I should say that in comparison with the number of dentists in the United States they do not make much of a showing.

Subject passed.

President Seabury.—Dr. William Y. Allen will present a new method of obtunding sensitive dentine.

Dr. Cooke.—Mr. President, Dr. Allen was not able to be here to-night, so he left the machine at my office, and I will endeavor to tell you all I know about it.

I understand, Mr. President, that this appliance is not new to Providence dentists. It has been used there for some time, and it consists of three parts,—a little alcohol lamp, a little boiler in which steam is generated, either from water or alcohol, and a little tube, about ten inches long, to convey the steam to the desired point. The amount of the steam is regulated by a stopcock. I tried the device on a brother dentist with pretty fair success. Also upon another case in which the secretions were in a very acid condition, and where I had had some difficulty in excavating. I started this flame,—the steam gets up in a few moments,—and, carrying this tube into the cavity, and allowing it to remain there a few seconds, I took an excavator and cut the decay out without pain.

I presume, Mr. President, that some of the Providence gentlemen can tell more about it than I can.

Dr. Eddy.—I suggest that Dr. Cooke light the lamp. All I know about it is that it was invented by a gentleman by the name of Small, and a dentist of the same name has been using it since last February. Dr. Cummings, I know, has personally used it.

Dr. Cooke.—This is alcohol in the boiler here. When first used I believe they put in water.

Dr. Williams.—Do you suppose that alcohol is better than water?

Dr. Cooke.—Yes; steam can be produced at a lower degree of temperature.

Dr. Fillebrown.—I would like to ask Dr. Eddy if he has seen any cases in which the use of it has been injurious?

Dr. Eddy.—Not at all. I have talked with one of Dr. Small's patients,—an intelligent gentleman, who has a very sensitive organism. He was very enthusiastic; having had buccal cavities filled with little discomfort, when formerly the pain was unbearable.

Dr. Potter.—What is the temperature of the steam?

Dr. Chandler.—If water is used, the boiling point would be 212° F.; if alcohol, about 174° F.

Dr. Potter.—What would be the effect if the hot steam were to come in contact with the pulp of the tooth?

Dr. Eddy.—Mr. Lippitt, the gentleman who spoke to me about it said that it could be put right onto an exposed pulp without any discomfort.

Dr. Pond.—Have you got to put the point of the tube right onto the dentine?

Dr. Cooke.—I understand it has got to be very close.

Dr. Williams.—Is the operation done while the tube is in the cavity, or immediately after?

Dr. Cooke.—You hold it there fifteen or twenty seconds, remove it, and commence excavating.

Dr. Taft.—I would like to ask Dr. Cooke if he considered it worked successfully on the two patients at the meeting of the Harvard Odontological Society?

Dr. Cooke.—In those cases the success was not marked, but that proves nothing. Clinics are not always successful.

Dr. Fillebrown.—I would like to ask Dr. Eddy, or some one who has had experience, if he thinks the sensitiveness is obtunded by the resorption of the moisture from the tubules of the teeth?

Dr. Eddy.—I would say, Mr. President, that I have had no experience whatever. Dr. Cooke has used it personally and can tell you more about it than I.

Dr. Cooke.—I should hardly think it was caused by the resorption of moisture, as, after using the steam, we must dry out the moisture which is condensed in the cavity before excavating. This is not so when alcohol is used.

Dr. Niles.—I want to say a word in regard to this steam obtundent. It was called to my attention a month or six weeks ago, and from my knowledge of its use in Dr. Allen's hands and my own experience with it, I am inclined to think there is some merit in it. I had yesterday a very good chance to test it, and I sent to Dr. Allen's office and obtained the use of it. The case in hand was the fracture of a superior central incisor of a young lad about twelve years of age. The tooth was broken about one-third the way up, and, in order to piece it with porcelain, it was necessary to smooth down considerable of the dentine. I used the steam and it certainly worked very well indeed. I found that after grinding off a little dentine, it was necessary to apply it again, and so by alternately grinding and applying the obtundent I was enabled to complete the operation, giving the patient little pain. In that operation it was certainly successful, and I for one do not feel like passing this matter over so lightly.

Dr. Eddy.—Dr. Allen has used it a great deal, and says that his patients would not think of having an operation performed without it.

Dr. Fillebrown.—The principle is good and there is no doubt it can be improved on. The boiler can be made to throw medicated solutions for various purposes, as is now done by the steam atomizer in throat diseases.

Dr. Cooke.—Dr. Allen made a step in advance by using alcohol instead of water.

Dr. Taft.—Isn't it liable to destroy the pulp?

Dr. Cooke.—It struck me in rather a ridiculous light when I first saw the machine, as it seemed as if it would surely cook the pulp, but by judicious use I do not believe this objection will be a serious one.

Dr. Taft.—How much of the tooth does it affect?

Dr. Cooke.—I find that two thicknesses of common note paper is about the depth that the dentine is obtunded.

Dr. Fillebrown.—I should say that if it was obtunded half the thickness of one sheet of note paper, it was a perfect success.

Dr. Baker.—I think myself this thing is worth investigating if nothing more, and I for one would like to try it. My attention has been called to it several times lately through my patients; if it has merit we have got to have it; if it has not, it will die a natural death.

Dr. Codman.—I saw the explosion here this evening, and I would not have such a thing as that happen in my office for five hundred

dollars. I don't think any dentist here would. We all know how unwisely people will act when they come into a dentist's office,—how they will do the most extraordinary and unexpected things, and how careful we have to be so as not to shake their confidence in us. I do not see the necessity of having the lamp placed near the patient's mouth, for accidents in its use would be fatal to the confidence of our patients.

Dr. Niles.—I think Dr. Fillebrown is in a position—being at the school—to make a thorough test of this apparatus, and I am sure the inventor will be very glad to loan one to the Academy for the purpose of investigation. It seems to be a risky thing to be experimenting with in ordinary practice until we have had some instruction in the use of it from some one who has had experience, and in the clinic there are plenty of exposed pulps and opportunities for experimenting that we would not have in our offices.

Dr. Banfield.—I will ask one question which I think might be very interesting, if those gentlemen who have used it can answer it, and that is, if they have themselves, or any one else, tried to destroy a pulp that they wished to remove, with this instrument.

Dr. Eddy.—I have never heard it spoken of as used for that purpose.

Subject passed.

Dr. Banfield.—The S. S. White Dental Manufacturing Company have kindly sent me their Howe Fissure Chisels to be exhibited to the society. Also, the Perry Dental Engine, which you will please examine.

Dr. Ham.—If there is no other business to come before the society, and the exhibition of dental appliances is now in order, Mr. President, I would like to exhibit a method of adjusting a rubber ligature to a regulating case. I have never seen it used by any one else, and I think it is original,—still it may be very old. Most of us are accustomed to using buttons, hooks, etc. I simply make a hole of proper size through the rubber plate, and on the palatal surface I countersink with a square ended bur. I then take a silk string and pass it through the loop and pull the end of the rubber ring through the rubber plate, and the resilience of the rubber will fill the countersink in the plate and hold the ligature firmly, I then clip the string off even with the plate and leave it in the loop.

The American Academy of Dental Science held its regular monthly meeting April 2, 1890, at the Boston Medical Library Association rooms. President F. N. Seabury in the chair.

Dr. H. A. Baker read a paper on "The Use of a Matrix in contouring Fillings."

THE USE OF A MATRIX IN CONTOURING FILLINGS.

BY DR. H. A. BAKER.

"After using all methods of separating by filing to get space between teeth for filling, I became fully convinced that the principle was entirely wrong, consequently gave the subject considerable thought." I was looking about for some other method to pursue when, in conversation with a professor in one of our dental colleges, I made to him the above statement. He replied, "If you come to my office some time, I think I can tell you of a method by which you will be able to save teeth." Upon availing myself of his invitation, I found his method was to bulge the fillings so that the tooth-substance would not come in contact, and was accomplished without previous separation.

After giving the subject further study, I came to the decision that it was an improvement at least, and went to work to put it to a practical test. Now, gentlemen, perhaps you can imagine my surprise when I found it a great deal easier to insert a contour filling in my mind than it was to put it in the distal surface of a twelfth-year molar. I persevered with the method, and the more I used it the more firmly was I convinced that the theory was correct.

About this time I began separating the teeth before filling, and with better results. While I was trying to simplify the work, it finally occurred to me, one day, that I had formerly used pieces of old files for a matrix in putting in a flat filling, which idea was, I believe, first introduced by Dr. Louis Jack. By drawing the temper and bending the file I had something approximating the contour of a natural tooth. Being more than pleased with the result, I felt that my future success, with careful work, was assured and much labor saved.

One day upon going to my case I accidentally took up a piece of thin copper. After bending this to the desired contour I inserted my wedge as I had formerly done when using pieces of file. The

copper yielded to the pressure of the wedge, and if I had continued it, there would have resulted a flat filling. I removed the wedge and tied a ligature about the tooth and copper, by winding around the tooth from the cervical wall to the crown just as a thread would be wound around a spool. I then proceeded with my filling. After the filling was completed the copper was removed, and, to my surprise, I found that I had a gold filling of nearly the exact shape of the natural crown; the edges extended just a little beyond the periphery of the cavity and the surface appeared to be almost entirely polished. After burnishing, I found that I had very little finishing to do, and had a beautiful contour filling. As far as I know, this is the first time the ligated copper matrix was ever used for this purpose. Since that time the plain copper has been replaced by the silver-plated, which reflects light well and so illuminates the cavity. I now became very much encouraged, and grew very bold in making the cavities broader, with the idea of keeping the tooth-substance a greater distance apart. By this time I became fully convinced that I was in possession of the most satisfactory method of saving teeth by filling, and I have ever since been a strong advocate of contour filling. Moreover, I have brought the method before several dental societies, and I believe that the last paper that I read before this society was upon that subject. I was criticised after making the bold statement that I had never seen decay around a well-contoured gold filling in a proximal cavity.

I stand here to-night ready to repeat the same statement with one exception, and that relates to a patient's mouth where I have proved that gold is not a good filling, and that her teeth are of a very poor quality, and would be quite as liable to decay around a crown filling as about a proximal one. For some time past I have used nothing else but cement or copper amalgam for her teeth. I am also accused of making another bold statement,—that I have never seen Weston's cement dissolve at the cervical wall,—and I am also ready to renew this statement. While at that time I gave the credit to the cement, I will make the assertion that I have never seen any of the well-known cements decay at the cervical wall. I believe it is not the kind of cement but the method by which it is inserted. I wish it to be understood that the point in question refers to a proximal cavity.

You may smile when I give the whole credit to the matrix. My point is, that the matrix should be fitted closely around the tooth, and the filling inserted and forced in, producing a filling of uniform density. By using force it can be crowded in and overlap

the periphery all around. The result is that the filling is as hard at the cervical wall as in any other part.

There are several kinds of matrices in use. It is difficult to decide between them; but this may be said, that the man who gave to the profession the steel matrix, encircling the whole or a part of the tooth and firmly held in position by some device, has given us one of the greatest boons that the profession is in possession of, and I do not hesitate to add—and I am ready to have it go upon the record—that any practitioner who does not avail himself of some of its forms now in use, and by its aid insert contour fillings in bicuspids and molars, reducing the operation to a simple filling, is far behind the times as an operator and does injustice to his patients by not giving them the most comfortable, serviceable, and conscientious work. The advantages of the matrix are too well known by the best and most careful operators to be discarded.

DISCUSSION.

Dr. Meriam.—I believe, Mr. President, I am limited to the presentation of new forms, but I think there are hardly any really new forms to-day. We have practically two,—a band encircling the teeth, or a plate held against the teeth by a wedge. The Baker matrix certainly comes between the two. It has the value of the band matrix, with also the advantage that it does not curl away from the teeth at the cervical wall, as do the band matrices that require, in addition to the ordinary tightening by a screw, a wedge to hold them against the teeth at that point. I have always regretted that Dr. Baker omitted to publish a description of his matrix, that it might bear the date of its introduction. In these days when companies are forming on every side of us,—when we know not what dental meeting may contain a spy, or what invention may be taken from the profession,—these matters are of importance. We should not publish our inventions merely for the fame and honor of the thing, but that the profession should be able at least to give some history, some source, from which our instruments spring. I know the claim is made that the instrument-case is the real birthplace of the profession; but, gentlemen, in spite of all the practitioners who are ready to echo that sentiment, I think that it is hardly true. Dr. Baker's matrix should have been given a name, and all the various forms that have grown from it should have been called a modification or improvement of the Baker matrix. I meet the idea in all parts of the country, but I

have rarely ever heard that Dr. Baker was the inventor, and I have often been obliged to show that he was.

I will present, first, some forms that were sent me by Mr. George Brunton, of Leeds, England, who offers a matrix that is tightened with a screw clamp, and also one that tightens with a screw wedge, or wedge clamp. These two forms I have here. They were sent me by Mr. Brunton through the courtesy of Dr. St. George Elliott, who was coming to this country. He also sent some to the Dental Schools of Harvard University and the University of Michigan, and, as some of the instructors of the former school are present, they can speak of their merits more intelligently than I am able to do. I think his key or wrench is the best I have ever seen, for, instead of the usual unsteady ones which we have, this has a guide, and by removing the ring it can be set at a different angle.

The matrix I prefer, in case only one wall is to be supplied, is a simple piece of steel, thick or thin, according to the distance between the teeth. For shaping the steel, the ordinary optician pliers (Stubbs's) gives a good form for bicuspids. The rounder pair of the French make (Tissol's) gives a better form for some teeth. Cold-rolled steel, with its evenness of working, the various thicknesses that are offered, and the ability to forge it somewhat, even when cold, into the shape we desire, is the most valuable. It is rolled to the thinness of five-thousandths of an inch in this country, and the French and Swiss watchmakers roll it down very much thinner. It can be procured from Goodnow & Wightman, Boston, Mass.; Wilkinson & Co., 184 Washington Street, Boston, Mass.; Chandler & Farquhar, 177 Washington Street, Boston, Mass.; Montgomery & Co., 103 Fulton Street, New York City; Frasse & Co., 92 Park Row, New York City; Peter A. Frasse, 95 Fulton Street, New York City; Niagara Stamping and Tool Company, Superior, corner Randall Street, Buffalo, N. Y.; Palmer, Cunningham & Co., 607 Market Street, Philadelphia; Simmons Hardware Company, St. Louis, Mo.; H. A. Pickering & Co., Cincinnati, Ohio.; Charles Strelinger & Co., 86 Woodward Avenue, Detroit, Mich.; Besley & Co., 175 Lake Street, Chicago, Ill.; Justinian Caire, 521 Market Street, San Francisco, Cal.; E. L. Parker & Co., 301, 303 South Charles Street, Baltimore.

I am keeping a list of these places, and shall be glad to be informed of others. The combination of instrument-makers can keep this steel if they wish; its cost is, I believe, about thirty-five cents per pound, and I am sure they will be glad to have us publish a list of places where it can be procured.

A remark has been made that the better a matrix fits the worse it is. In many cases there is danger in narrowing the orifice of the cavity. I saw Dr. Bogue using a flat piece of steel with a broken end of a gum-lancet for a wedge. I think he told me he knew of others who had used it at about the same time as himself. In one case I have used the wedge itself as a matrix. The flat steel has this advantage,—that the matrix fitting against the gum can, with this narrow wedge, be tipped back against the adjoining tooth, and the walls of the cavity are exposed to view and can be reached at all points by the plugger. The excess of gold is only at the edges of the matrix. I have made some wedges for this matrix, shaped like a knife-blade, except that they are more curved, and with the thicker end flattened like a spoon-handle, opposite from the blade of the wedge; this makes them easy to insert or remove with the fingers without the aid of pliers. They are easily made of differing lengths and thicknesses, of copper or German-silver wire. In some the flat end is curved back so as to rest against the gum, holding the rubber dam away from the tooth.

I would like to call attention again to the use of gutta-percha as a matrix, not only for filling with amalgam but with oxyphosphate, and especially for applications of medicine in treatment, and the ease with which a molar tooth can be converted into a simple tunnel with gutta-percha as a matrix. And also the safety with which arsenic can be applied,—putting on the rubber dam, varnishing the edges of the cavity and the adjoining tooth, using a soft, low grade of gutta-percha, making the application thin, and covering with cotton and another piece of gutta-percha. When the patient returns for removal of application, only the latter piece of gutta-percha need be removed, leaving the funnel intact, the arsenic or other application may be syringed out, and further treatment given if needed. The certainty of result, where medicine is in contact with the tooth without being diluted with the fluids of the mouth, is very much increased, and it has the added advantage that, as far as odor is an indication, we have it isolated from fermentation, and know that it comes entirely from the cavity, if there is any odor.

There is another advantage which the matrix has in the Buckland method of inserting amalgam. It is his practice to put oxyphosphate against the pulp wall in shallow cavities, and packing the amalgam against that, taking care of all the edges, and forcing some points of the amalgam into the soft cement. This method can be reversed with the matrix by packing the amalgam against

it and against the side wall, then placing thin cement against the pulp wall and covering with amalgam. Results will be better if the matrix is left in place until the amalgam is hardened.

The gutta-percha matrix can be used for oxyphosphate, and, by covering the crown of the filling with gutta-percha after insertion, the filling can be protected from moisture as long as need be.

Dr. Wilson.—I have a matrix consisting of a thin band of steel; on the ends of the steel are two posts, one threaded and the other smooth, and it is tightened by a screw. I prefer it to any other matrix.

Dr. Meriam.—This thin, hard rubber, furnished by dealers in electrical supplies, makes a matrix that is very readily adapted. A little heat softens it so that it is readily cut with a pen-knife.

Dr. G. T. Baker.—I would like to present something which I have here that I have used for a matrix with a good deal of satisfaction. It is made of Dr. Parmly Brown's German-silver polishing strips and the Lee pull-back for a screw. A piece of silver, a little longer than will reach around the tooth, is cut off and a hole punched through both ends, through which the screw passes into the nut. It is then tightened with the key. I will pass it around.

Dr. Stevens.—I want to emphasize one thing that Dr. Baker said, and that is in regard to the durability of cement fillings at the cervical wall when the filling is properly inserted. I have made the assertion to some of you here that my experience was that cement fillings did not waste away at the cervical wall when they were properly inserted. Dr. Baker is right with respect to that point. I had a case the other day where a cement filling had been in the mouth six or seven years, and all that remained of the filling was at the cervical wall, and it has been my experience that a cement filling made with any good cement, and properly inserted, will last longer at the cervical wall than at any other point.

Dr. Barker.—As long ago as my student days I saw a matrix used. It consisted of the uncut and drawn tempered end of a separating file supported by wedging. This may have been the forerunner of that class of matrices of which Dr. Louis Jack's is a good type. Such matrices are available only when teeth are in contact. Where teeth are not in contact it is necessary that the matrix embrace the tooth to be operated upon, and not depend for stability on an adjoining tooth. To meet this want various loop and band matrices have been thrown on the market. One of them, which I procured of Dr. Coull, in Washington, I have used with reasonable satisfaction. It is essentially the same as the matrix

Dr. Wilson has described to-night. In my own practice I have found that a matrix improvised at the chair is more valuable than one I can buy. My plan is to use a thin strip of copper, brass, or German silver having one side silver plated. I cut off a piece of the metal a little wider than the depth of the cavity, loop it about the tooth, and grasp the free ends with a pair of pliers, thereby bringing the matrix firmly about the tooth. The band is then removed and soldered with soft solder, after which it is slipped back onto the tooth. If you have done your work accurately, you will find your matrix fitting with reasonable firmness, but, if need be, you can then insert a simple wedge at the point where you have done your soldering and have a matrix, all things considered, much better than anything else I have seen used.

The difficulty with a matrix is to get it close to the cervical border. This can be accomplished by the use of burnishers. The best result is attained by preparing the cavity and filling it with gutta-percha, or some material of that kind, making the contour of just the form needed. Form the matrix to this and then remove temporary filling.

There is another subject of which I wish to speak,—and that is, the incidental matter which Dr. Baker brought up, and which Dr. Stevens has alluded to, concerning the dissolving out of zinc phosphate fillings. I supposed that I knew how to handle oxyphosphate, or zinc phosphate, as well as anybody. I have put in a good many such fillings, I think, intelligently and with care, following the directions as we get them at the dental depots. In spite of care, the zinc phosphate fillings, after a couple of years, have dissolved and disintegrated, whether by the action of alkalies or acids I do not know. I only speak of my own practice. I have ceased entirely to rely upon zinc phosphate filling at the cervical wall. I always use a gutta-percha there and build down with a zinc phosphate. If there is any principle or method by which we may use zinc phosphate fillings more effectually, I would like to know it. Dr. Stevens says they should be kept dry. Let me say that follows as a matter of course,—it ought to go without saying that we insert zinc phosphate fillings under conditions of dryness. I use the rubber dam almost everywhere, and allow not less than twenty minutes to half an hour, or even longer if I can get the time, for a zinc phosphate filling to harden,—and yet I get these results. I do not use the zinc phosphate in a creamy state, but in a condition of good consistent putty, so that the mix is reasonably firm, and allow it to set unmolested and undisturbed.

Dr. Smith.—I would like to ask the gentleman if he uses a matrix in putting in his zinc phosphate fillings?

Dr. Barker.—No, sir, I do not.

Dr. Smith.—By doing so you will find that you will get more solidity to the fillings.

Dr. Barker.—Do you claim that there is any efficacy in the material being put against a metallic surface?

Dr. Smith.—Not particularly, but you could pack the filling in so much more firmly.

Dr. Meriam.—I have never seen either oxyphosphate, oxychloride, or gutta-percha that did not dissolve in an acid mouth. The oxide of zinc itself is soluble in both acids and alkalies, and, in buccal cavities in the lower third molars, what is called the "rotting" of gutta-percha is really the dissolving from it of the oxide; and I question if, in this position, phosphate of zinc fillings would last even if put in with a matrix, assuming that the patient did not give increased care, and thus change the conditions. We should remember that the phosphate of zinc may be soluble in one mouth and not in another. I keep in my medicine-case a dilute acid, the "pickle" of gold workers, which I use when I am doing small soldering. After mixing my oxyphosphate on the ordinary porcelain slab, I wipe the adhering cement from the slab with a little of this acid on cotton. Of course we have no acid so strong as this in the mouth, but it shows that the cement is soluble in acid.

Dr. Baker.—My point is simply this: by using a matrix it will enable us to do what we cannot possibly do without it. We get a uniform solidity to the filling.

Dr. Meriam.—I will show a new root-canal drill that was also sent over by Mr. Brunton. This has come in a letter since he sent the matrices. There is nothing new about it, with the exception that it is made from piano-wire, and is supposed to give us a point that will not break in the roots. Mr. Brunton writes that it is to be mounted for the hand-piece. When I go to New York I shall give it to Mr. Schmidt, and any one who wishes can order them from him.

I have a letter here from Dr. J. Morgan Howe, who sends me one of his new cervical retainers and clamp. He writes me as follows:

"The point of originality, which must be protected from appropriation by any enterprising egoist, is the invention of the cervical dam-retainer, which is a face-piece, so shaped as to be capable of

being bound to the tooth by a clamp, or by any other means (no matter what), retaining the dam above the cavity, and at the same time permitting access to it. If you will remove the clamp with the forceps (from the tooth sent you), leaving the face-piece *in situ*, held by a piece of floss silk, you will see, I think, that where teeth are not very near to their neighbors a face-piece could be bound to the tooth with thread or its equivalent, if it were found desirable to use such means instead of a clamp. The retainer or face-piece can be modified in shape to any extent required for various cases, and still retain its identity. In individual cases (especially molars) it might be found best to make a retainer somewhat U-shaped, and bind it by the free ends to the tooth with floss silk. Then apply the dam, using thin rubber.

THE American Academy of Dental Science held its regular monthly meeting May 7, 1890, in the Boston Medical Library Association rooms, President Seabury in the chair.

Dr. William P. Cooke read a paper upon "Formations in the Pulp-Cavity."

FORMATIONS IN THE PULP-CAVITY.

BY WM. P. COOKE, D.M.D.

These deposits have long been recognized. In 1780 and in 1835 the fact was spoken of; also by Tomes in 1846.

These formations may be classified as follows:

1. Secondary dentine,—normal.
2. Nodules attached to the wall of the pulp-cavity.
3. Nodules loose in the pulp cavity.
4. Calcifications, loose, easily distinguished from the others by their white chalky appearance.

The fact that dentine is deposited by the pulp as the teeth are worn down was recognized by Dr. John Hunter in 1800. The tubuli are continuous with the normal dentine, and have a similarity of arrangement in the dentine of repair, but in the loose and nodular formation there is no similarity of direction.

Cause.—The cause may be external or spontaneous. They were believed by Mr. Hulme to be caused by irritation set up by a decaying cavity, the deposit forming as long as the irritation is kept up.

The cause may be similar to the one which causes ligament to be changed to cartilage, cartilage to bone, the deposit in the coats of the arteries, the ossification of the cartilage of the ribs, and the deposits in the brain. Some may be caused by age; for others we rely upon a constitutional tendency. Syphilis and gout cause nodes in bones and possibly these formations in the teeth. When these are laid down there is an increased supply of blood, so any cause which produces this increase of blood-supply may favor the deposit, such as caries, recessions of the gums, or absorption of the alveolar process, by which means the pulp is more exposed to heat and cold; large metallic fillings, lack of occluding teeth, undue striking and irritation by clasps. Wedl thinks, while many old teeth have new formations, as all do not have them, the cause must be sought in an independent process which is not accompanied by pain. Chronic pericementitis may be a cause,—if on one root only, the deposit will be laid down in that root.

Effects.—The effect of these deposits is not wholly known. In some cases severe neuralgia is traceable to this source. In these cases the patient may have sharp lancinating pains, teeth very sensitive to thermal changes, also to excavation; itching and slight uneasiness at any time, a continuous boring pain in one spot, sensitiveness of enamel on scratching with finger-nails, slight external inflammation of gum, and soreness of the tooth to percussion. Wedl thinks that pain is not produced by calcifications until they are quite large. Cases are on record where several teeth have been removed at different times for the same patient, and the deposit found in each case was supposed to be the cause of the neuralgia. If in these cases we must extract, it is advised to first allay the pain, as the neuralgia is less liable to follow.

These deposits may have an important bearing in pulp-capping. Some writers claim that when the layer of odontoblasts have been destroyed, no new deposits of dentine will take place, but that we may expect that in a healthy pulp calcification will occur at the point of exposure.

Shape and location.—These deposits vary from a small speck, scarcely visible without a glass, to those that nearly fill the pulp-cavity. These are surrounded by a delicate membrane, which prevents their uniting with the wall of the pulp-chamber. This accounts for the difficulty we have in devitalizing such teeth, the application acting on a small portion of the membrane only. A touch upon the deposit causes pain by producing pressure on the live tissue on the other side of the deposit.

These calcifications are found in the bundles of connecting tissue and the sheaths of the blood-vessels.

Salter thinks the calcifications begin at different points, and at last pass into one mass. He also thinks the new deposit is at last fused and confounded with the dentine. If this were so, we would find the whole pulp-cavity filled, which we rarely, if ever, do. Many times the deposit is found at the mouth of the pulp-canal, and must be removed before the canal can be cleaned. When the deposit is loose this is comparatively easy, but when the canal is covered by one of these growths that comes from the wall of the pulp-chamber, especially from the point of bifurcation of the roots, it is not very clear which way we must cut to reach the canal. A case in point, where the deposit was drilled three-fourths through and then the pulp-chamber and remaining roots were filled, after-trouble caused the removal of the tooth, and this might have been avoided by drilling a little farther, but caution forbade such

a course. The largest deposit I have found in the molar teeth was in that class that have probably stood the shock of mastication for years; also in the dark-yellow teeth, many of which have been lost by Riggs's disease. With a little experience we may select from a number of teeth a majority which will have deposits in them. This refers to the dark-yellow dentine deposits, not to the calcification which appears to be in much younger teeth.

In one case of a lower wisdom tooth, where probably the decay had been rapid, and had progressed till the pulp was exposed, the whole of the pulp-chamber was filled with a white deposit, which was loose and had a membrane between it and the wall.

In the canines the apex of the pulp is most often ossified, but in many we find the small round nodules, which are in the substance of the pulp. Several may be present. They are deposited directly under a filling and seemed to be caused by it, though they may have been there before it was inserted.

The safe course in the treatment of devitalized teeth is to open well into the pulp-chamber, and by this means we may obtain access into the canals. In the majority of cases I think no trouble arises primarily from these deposits.

Frequency.—Salter claimed that every tooth had its pulp more or less ossified, and that it occurs oftener in the roots. Some claim it is more frequent in young persons, and in deciduous more than in permanent teeth.

I do not find this to be the case, but rather the reverse. It undoubtedly occurs more with chronic than with acute caries.

These deposits are not confined to humanity, as similar ones are found in the teeth of the deer, hare, pig, and walrus.

These deposits have no relation to the exostosed teeth. In the *Dental Cosmos*, vol. v. (1863–64) is the record of ten thousand teeth examined for exostosis, with the following results:

	Per cent.
Carious teeth, 6200, exostosed 319	5
Sound teeth, 3000, exostosed 85	4
Average exostosed	4
First, molar, in 4000, 210 exostosed	5
Second, bicuspids, in 2000, 94 exostosed	4
Third, incisors and canines, 250, 10 exostosed	4

The greatest frequency is found in molars. Exostosis being caused by a constant, though slight, irritation to the pulp, and in this respect these deposits resemble it.

Some five years ago I commenced a series of investigations to determine the frequency of these deposits in human teeth. I have examined teeth collected in three different parts of the State and with the same results. The teeth, being dry, were cracked upon a small anvil and the contents of the pulp-chamber examined by a strong glass. Accurate records were kept as to soundness, decay, etc., and with the following results:

	Teeth examined.	Deposit.	Per cent.
Incisors decayed	521	28	5
" not decayed	179	11	5
	700	39	5
Bicuspids decayed	539	29	5
" not decayed	161	7	4
	700	36	5
Cuspids decayed	140	10	9
" not decayed	160	31	19
	300	41	13
Superior molars decayed	1054	293	27
" " not decayed	551	191	34
	1605	484	30
Inferior molars decayed	1089	297	27
" " not decayed	606	145	23
	1695	442	26

RECAPITULATION.

	Total examined.	Deposit.	Average per cent.
Molars	3300	926	28
Incisors	700	39	5
Bicuspids	700	36	5
Cuspids	300	41	13
	5000	1042	

DISCUSSION.

Dr. Codman.—I think this is too good a paper to pass without every one present saying something on it. Surely the facts are placed before us, and there were several which came up which seemed to me to be extremely interesting. The one that strikes me first, and is of the most interest to me, belongs to the sections of

exostosed teeth. I was not aware before that exostosed teeth had this deposit as large or larger than others, and it brings up an interesting question in my mind,—Was the deposit in the pulp-cavity first, or the exostosis, or did they come together? It seems to me that the deposit in the pulp-cavity occurred first, though both may have taken place at the same time. It is a matter which, at first sight, does not seem to be of any great importance, but still it is a leading point towards the solving of the problem of the irritation. My theory is, and I believe it is also the theory of the essayist and most of the other gentlemen who have written upon this subject, that a certain amount of irritation produces these deposits. We have seen it illustrated by the fact that pulp-stones, at least in a great many of the cases, are deposited directly under fillings,—directly under cavities,—where the greatest amount of pulp-irritation has at some time taken place; hence, in endeavoring to solve the problem every point like this is worthy of consideration.

Dr. Brackett.—I must add my expression of appreciation and gratification for the paper that has been presented before us. I have been very much impressed with the improved method of demonstration over that prevailing in former times, and this, added to the foundation facts shown, has made it very interesting and instructive for us. It seems to me that the essential fact in connection with all of these cases, and that has not been very prominently mentioned, is the presence of an abundant supply of lime-salts in the system. I have never yet seen anything of this kind in a deciduous tooth, and I think it is the experience of most practitioners that the percentage of deposits of this nature increases with age, increases coincidently with the process of calcification in other tissues with advancing years, as it takes place in cartilage, as it takes place around the periphery of the pulp, as it takes place in the coats of the arteries and valves of the heart, and so on, indefinitely. I should simply add to the expression of the last speaker, suggesting irritation as a determining factor in the development of this condition, that we may assume as another element the abundant supply of lime-salts in the system. An analysis of the skeleton in the cases of teeth having this dense structure would, I think, show a similar result in nearly all its parts. That is to say, such teeth, having either of these conditions,—hypertrophy of the cementum, or calcification within the pulp-chamber,—are more apt to be found in persons having an abundant supply of lime-salts than in individuals where the supply of lime-salts is lacking.

Dr. Eames.—I am very much pleased to see the illustrations of this pathological condition. I have been struck with the force of the many facts that have been brought out, and shall easily remember them because they have been so plainly illustrated. I am moved to speak because I feel that there are those who have noticed these formations early in life. I must say that, so far as I have observed, I have seen more of them existing in persons in early life, even in deciduous teeth, but more particularly in young persons of from twelve to eighteen years of age. It has been pretty well shown that these deposits originate from irritation, and there may be a variety of these conditions, and not so much because there is an abundant supply of lime-salts in the system. For some reason the lime-salts may be diverted from their regular channels and be deposited here or there. We may fill the system, saturate it, so to speak, with lime-salts, and if the natural channels, with their corresponding nerve-supply, are in a healthy condition, the lime-salts will not be found in excess anywhere in the body, neither on the skeleton, nor in the pulp-cavity, nor on the teeth in the shape of exostosis. There are lime-salts enough in the common food that we eat daily to supply what is needed for a normal condition; but even if we take a case that is not plentifully supplied with lime-salts and produce a sufficient irritation, we may have an irregular formation in the system, an exostosis, because of the irritant. The fact that we find these formations in adults does not prove the time of their origin. They may have begun in childhood and kept increasing more or less slowly until they come to our notice later in life.

I might say that within two or three weeks I amputated a tooth which was apparently sound. There was certainly no pain or discomfort to the patient, and I found quite a large ossified condition in the pulp. It was a right superior lateral.

Dr. H. F. Hamilton then read a paper on "The Combination of Tin and Gold as a Filling-Material."

THE COMBINATION OF TIN AND GOLD AS A FILLING-MATERIAL.

BY DR. H. F. HAMILTON.

When Dr. Charles H. Abbott, son of the late Dr. Frank Abbott, of Berlin, was in this city some years ago, he told me of the value of tin and gold as a filling-material, and asked me to try it, but did not go into particulars as to its special advantages or

methods of working. At that time, in weak teeth of adults and in children's teeth, I was using tin, either foil or Robinson's metal, to some extent, and in some doubtful cases, instead of these, I tried the tin-gold according to my own ideas as to how it should be used. From time to time I saw these fillings; and their appearance encouraged me to more extensive use, until now I fill several cavities each day with it. I am led to speak of it to-night, not to claim any ideas or methods, but simply to call your attention to it and ask you to give it a trial. I use it where formerly I should have used cement and gutta-percha, and not in cavities where gold will stand, except those in the crown of the upper wisdom teeth.

In all my work with tin-gold I have seen decay come only twice, which meant undoubtedly defective work. I was very clumsy in my earlier efforts, not having had such a knowledge of the working of soft gold as many of you have, and from that reason two or three fillings came out piece by piece; but continued practice soon remedied that, and now I find tin-gold to be as easy and sure to work as gutta-percha. The theory and advantages of this method are admirably set out by Dr. Miller in the May, 1889, number of the *Dental Cosmos*, and his article will tell you far more than I can of my own knowledge.

I use it chiefly in crown cavities in molars for young persons and the wisdom teeth of adults; in small approximal cavities back of the cuspid for all ages, and in nearly all buccal and palatal cavities. I never put in a gold filling of any size in an approximal cavity in the bicuspids or molars without a few pieces of tin-gold at the cervical wall. I often fill two-thirds of the cavity with tin-gold and then build on a grinding surface with crystal gold or annealed cylinders. I top the tin-gold out with gold in this way for appearance' sake, and I also feel surer of my contour; although with more experience I should have no fear of the latter not being perfect.

I use it with wedge-shaped soft-foil pluggers, and prepare it for each cavity by rolling a part of a sheet of tin inside the same proportional part of a sheet of gold and cutting it off so as to leave the pieces diamond-shaped. There is a foil-trimmer that belongs with the Harvard set of pluggers that I find very useful in condensing.

I will read a few extracts from Dr. Miller's paper, and in conclusion ask you to try tin-gold. I feel that it has made life easier and my work much more satisfactory to myself.

DISCUSSION.

Dr. Briggs.—I would like to add my testimony to that of Dr. Hamilton with regard to this combination. Dr. Hamilton spoke to me about it some two and a half years ago. I tried it in several cases and waited a year to see what the result would be. In the mean time I did not hear anything further about it, and did not know of any one else using it, but at the end of a year the results were so satisfactory that I have been using it ever since. There is scarcely a day passes that I do not put in one or more of these fillings. I use it in many of those cases where formerly, as Dr. Hamilton says, I used cement or gutta-percha. I feel it is almost as conservative a filling as either, and almost as easy to put in, while it is of course perfectly durable.

Dr. Williams.—I should think it was about six years ago that a lady came to me who had been a patient of Dr. Frank Abbott, in Berlin, and showed me some fillings of this combination, which she stated Dr. Abbott wished me particularly to inspect. He also sent a letter to me which she had lost, so that I was unable to know what he had to say about them. I found them doing admirably, several of them being large fillings, and all of them in approximal cavities, up near the borders of the gum, well preserved. I kept watch of that case, but I found that the inveterate enemy caries did get in at one or two places. It is not a specific; it does not prevent decay absolutely.

Dr. Banfield.—I would like to ask Dr. Hamilton if the method requires considerable separation before insertion?

Dr. Hamilton.—With this, as with other materials, space is an advantage. I separate about one-half as much as for a filling of gold alone.

Dr. Clapp.—What gold do you use?

Dr. Hamilton.—I use Knapp's foil. It is non-cohesive and softer than soft gold.

Dr. Taft.—This subject of combination fillings has long been an interesting one to me, and though I have had no experience as yet with this material that Dr. Hamilton speaks of, I feel encouraged to try it after listening to his paper, and I am very glad he has brought the subject before us. The article in the paper to which he has referred I do not remember having seen, but I shall take a good deal of interest in reading it over. I should like to ask if the filling is put in exactly like a soft gold filling, that is to say, by the wedge process?

Dr. Hamilton.—Yes, as nearly as my experience with soft gold is concerned. I have never used very much soft gold.

Dr. Codman.—I think most of us who have read the *Dental Cosmos* must have noticed the articles on combination fillings that have appeared from time to time, but a good many of us have not tried them, because there seems to be no reason why the combination of two *pure* metals, as tin and gold are supposed to be, should produce any new result. Now we would, all of us, like to know, if it is really so, if there is any change which goes on between these two metals. I do not pretend to be up in chemistry to know for a certainty, but it seems to me that no change can take place unless there is an intervention of a third oxidizable metal. The ordinary tin-foil is not pure, it contains lead, and it is possible that the combination of the tin, the gold, and the lead produces the result spoken of. When the metals are brought into contact the lead begins to oxidize at once, and this enlarges the filling by a slight increase of size. It is tight, and grows tighter by the very fact of its enlargement. This may be the philosophy of it. Of course, there is still pure metal enough to hold the filling together and hold it strongly, but there seems to be some reason why the combination of two metals should be better adapted than either of the metals individually.

Dr. Williams.—Does Dr. Codman think that the tin-foil that is usually sold contains lead to any appreciable extent?

Dr. Codman.—Yes, sir. In chemistry it is not always necessary that there should be a large amount of the intervening metal to bring about action between the other two metals. I really do not believe that there is lead enough in the tin-foil to do any physical harm, but I do believe that a large proportion of it contains some lead.

PRESENTATION OF SPECIMENS.

Dr. Smith.—I received a letter from Dr. Brackett this afternoon, saying that he would be present,—possibly late,—and would have with him a warm-air apparatus, as he expresses it. I did not receive it in time to have it put on the card. Also, I did not know of Dr. Hamilton's paper in time to have it announced, but Dr. Hamilton has had a standing invitation to read a paper whenever he feels so inclined.

Dr. Brackett.—Mr. President and gentlemen, this is an apparatus for which I am indebted to our friend Dr. Bogue, of New York, and it came to my mind, just as I was starting from home, that I

was indebted to him for a great many things, tangible and intangible. Of the tangible things, I have here one of the earlier forms of apparatus for pressing teeth apart immediately. Of all such contrivances, it is the one which I use with the most satisfaction. It is especially applicable to molars and bicuspids, and is one of two instruments which he made; one he kept himself, and this one he gave to me.

This is one of a pair of instruments that are partially home-made by Dr. Bogue, and is presented simply as a mirror, the narrow oval of which makes it especially applicable in reaching far back in a mouth that does not open very wide. The glass and frame were made by C. Ash & Sons; the handle is an individual thing.

The warm-air apparatus is designed especially for lessening the sensitiveness of cavities. Of the variety of principles upon which obtundents operate, one of the most valuable is the principle of dryness. If we imagine, for the sake of explanation, a jelly-fish completely desiccated, and compare it with the jelly-fish under normal conditions, a marked difference in everything that goes to make up the functions of its tissues would be apparent. Applying this principle, we can easily understand the difference between the cutting of a tooth when it is freshly extracted and cutting it after it has been exposed to dry air for indefinite months. It seems to me that of all means for obtaining dryness by a hot blast this apparatus is as simple as anything can be. The cylinder is heated over an alcohol lamp, or Bunsen burner, and air is supplied to it by means of a simple rubber bulb, with valves, and an interposed elastic chamber, the whole similar in operation to the blower used in soldering. The amount of heat can be regulated by the amount of heat that is given to the cylinder, or by the rapidity of blowing and the distance that it is held away from the tooth. In those cases where dryness can be applied I have never used anything so satisfactory, and apparently so harmless, as this very simple apparatus. It is the design of a French workman, not a dentist, and I believe they are not yet to be had in this country. Just what they will cost I am unable to say, but in France, I believe, the cost is about six dollars. The success which Dr. Shumway had in making cohesive gold work satisfactorily with the smooth instruments which he used was directly dependent upon the attainment of great dryness. You will find, by holding that close to the face, quite a little degree of heat, and the circumstance of the current of air steadily flowing does a very great deal in accomplishing dryness. It is possible in a few minutes to make a tooth cut so that it will ring under the ex-

cavator like a tooth that has been extracted for several months. In exhibiting this apparatus before the Academy I do not wish to take any of the honor to myself, but I present it to you as the contribution of our friend Dr. Bogue.

There is one point in connection with the warm-air apparatus which I forgot to mention, and that is, it is a very nice help to hasten the hardening of a cement filling, thereby saving time, and adding to the durability of the filling.

[1] The American Academy of Dental Science held its regular monthly meeting March 5, 1890, in the Boston Medical Library Association rooms, President Seabury in the chair.

President Seabury.—If there are no reports of committees, the next thing in order is Dr. Brackett's paper "Concerning Third Molars."

CONCERNING THIRD MOLARS.

BY DR. C. A. BRACKETT, NEWPORT, R. I.

When our good Executive Committee honored me with an invitation to read a paper before you, I was moved by a number of considerations to take the subject which has been announced. I have little to say in theory, but there are connected with the third molar practical points whose careful consideration may be profitable for us, and through us of great advantage to those who come to us seeking relief from some form of suffering which a third molar may occasion.

The third molar is a tooth against which, justly or unjustly, much is said. There is a popular prejudice against it as "a black sheep in the flock, even shorn, which comes up from the washing." Patients say, "If that is a wisdom tooth, I don't want to have anything done to try to save it, because it is sure not to last. Wisdom teeth are decayed before they are half through the gum; they are forever coming, and all the while are a source of torment. From beginning to end there is nothing good about them, and I don't see why we have wisdom teeth anyway."

It must be confessed that there are numerous instances in which such statements are not a distortion of the truth. The teeth are valueless, and worse than valueless, and often patients do suffer from them seriously and extremely; but to condemn the third molar *in toto* and indiscriminately is not warranted. There is another aspect of the subject, and in fairness it should be presented.

With a view of determining the relative frequency of decay with the different teeth, Dr. Magitot has prepared a table, from the results of his examinations of permanent teeth for caries, showing that, of ten thousand instances, but three hundred and sixty were of the third molar. By Magitot's table the order of frequency of caries of the different teeth is as follows: Lower first

[1] These proceedings have been delayed by the non-reception of the paper of Dr. Brackett, and are necessarily published out of the regular order.—[Ed.]

molar, upper first molar, lower second molar, upper first bicuspid, upper second bicuspid, upper lateral incisor, upper second molar, upper central incisor, lower second bicuspid, upper canine, lower first bicuspid, upper third molar, lower third molar, lower canine, the two lower incisors.

This showing is remarkably good, and the position in the scale of the third molar next to the lower canine is a place of great honor. Were the ten thousand instances of caries equally divided among the different classes of the thirty-two teeth, the four third molars would be entitled to an eighth of ten thousand, or twelve hundred and fifty, instead of the three hundred and sixty which were found. We do not know the ages of Magitot's patients. Presumably the cases were consecutive ones for examination in practice, and doubtless included a fair proportion of patients not of an age to have third molars; but allowing this to be the case, a moment's thought will show us that such is real life, and if we are seeking to get at the proportion of cariously infected third molars to cariously infected other teeth, I do not see that there is reason for believing that there is great fallacy in Magitot's figures.

The late Professor T. B. Hitchcock prepared a table of twenty thousand cases of fillings and of extractions for all reasons, chiefly, of course, for caries, the cases of filling and of extraction being all grouped together. Of these twenty thousand cases, nineteen hundred and twenty-four were third molars. A full eighth would be twenty-five hundred, or nearly thirty-three per cent. more than the actual; but of the twenty thousand, the number of first molars was forty-four hundred and ninety-nine. Without going into too much particularity, the order of frequency of affection by Dr. Hitchcock's table is,—upper and lower teeth being grouped together,—the first molar, the second molar, the second bicuspid, the central incisor, the first bicuspid, the lateral incisor, the third molar, the canine. Classing the upper and lower incisors together modifies the place of each in the scale, but does not affect the relative position of the third molar, which has here again honorable showing, so that after making all allowances for circumstances influencing the figures in the table, the deduction seems fair that the third molar is not among teeth the one most prone to caries.

There are reasons why we might look to find it a better tooth than the others, prominent among these reasons being, of course, the circumstance of its development at a time in the age of the individual when the constructional powers are at their best. Given a good heredity, with no mischief-making mixing of family types,

with no disproportion between the size of the teeth and the size of the jaws, with proper diet and proper regimen in all particulars throughout the period of development, it is reasonable to expect to find—and practically we do find in cases of this kind—an approach to perfection of organization and arrangement in which the third molar is no exception to the general rule; and there are, as we all know, instances in which the later rather than the earlier circumstances of growth were most favorable, in which the third molar is the best tooth in the mouth. It is also often an excellent tooth in mouths from which other molars have been early lost, so that it has ample room for development. A beautiful specimen of good formation may be found, in a large proportion of cases, by cutting down upon and extracting a third molar before it has erupted at all, and before it has become a pathological centre through impaction, malposition, or difficulty or delay of eruption. Not all third molars are perfect in formation, but a practical study of the subject will show that a much larger proportion of them are formed perfectly than remain perfect. Many of them are more sinned against than sinning. They are the victims of unfavorable circumstances, of bad environment, of unhygienic conditions, of poor ventilation, imperfect drainage, lacking cleanliness, microbe pollution, malaria,—all of these in the immediate, local sense intrinsic in the investments of the particular teeth, or more generally in the system of the possessor of the teeth or in his surroundings in turn, disproportion between the size of the tooth and the place which is provided for it to occupy in the world, slow eruption, overlying gums, surrounding inflammation, and its regular, overhanging cheek, comparative inaccessibility, so that it cannot be reached well by the ordinary means of grace and salvation for teeth,—these and similar elements of the situation should come in for that just estimation which will relieve the tooth itself of much of the odium generally bestowed upon it.

The question whether there is in the frequently-obtaining characteristics of the third molar an illustration and proof of the doctrines of Darwin is an interesting one. I myself believe that we are sêeing in the cases of difficult, poor, and dwarfed development of the third molar, and in the not very rare instances of its entire non-appearance among people living under the more artificial conditions, evidences of nature's economy, of the adaptation of means to ends, of the non-development of that which is not demanded. The good development of the third molar in races requiring of their entire masticatory apparatus the most vigorous service is well known.

There is a legend that there have been found fossil remains of an old race of giant men with four well-developed molars in each half of each jaw, but my inquiries thus far have failed to substantiate it. Dr. W. C. Barrett has told me that he has found nothing of the kind. Professor F. W. Putnam, curator of Peabody Museum of American Archæology and Ethnology, has kindly written me this: "In answer to your letter about skulls containing the fourth molar, I can only say that I do not remember ever to have seen such a skull, nor can I recall any mention of one. Dr. Boas, who has examined a great many skulls, is working at our Museum today, and he informs me that he has never seen the fourth molar. On the contrary, we both agree that the absence of the third molar is quite a common event."

The not infrequent failure of development of the third molars is a fact to be considered in connection with any suggested situation of the first molars. Doubtless we have all of us seen a number of instances in which, through the sacrifice of the first molars and the non-development of any third molars, the patients have to go through life with but one molar in each quarter of the mouth. Especially is this undesirable state to be guarded against if either parental branch of the child has failed to develop third molars. Such dental peculiarities are very likely to be transmitted from generation to generation.

An old theory which held that carious third molars present in the mouth were a protection to the other teeth through the exhaustion upon themselves of the disintegrating forces appears in the light of modern etiological science rather ridiculous.

The *vis a tergo* of the erupting or erupted third molar may be helpful or harmful to the position of the other teeth according to circumstances. It may serve as a strong buttress to maintain firmly apposed the bulbous proximal surfaces of the other teeth all around the arch; its eruption may close up otherwise existing open spaces; its crowding already overlapping, irregular teeth may markedly increase the deformity of an arch without a key-stone in place; its retarded difficult eruption or efforts at eruption in insufficient space, perhaps itself malposed, is not rarely a source of extreme discomfort, pain, and disability long continued, or recurrent perhaps for years. Irritation, inflammation, and suppuration of its immediate investments are but a portion of the mischief it entails. Happily for escape from lasting disfigurement, abscess about the third molars, whether from crowding or from dead pulp, has less tendency to point externally than have such affections with

other lower teeth. Troubles with the throat, with the ear, and other organs of special sense, and many neuralgias in regions that might be supposed to be out of the range of such influence arise in many instances from these third molars.

A practical point in diagnosis to be remembered is that pain often seems to be located more in the peripheral distribution of a given nerve-supply than it really is, farther forward in the mouth, or, through reflex action in situations more or less remote from the actual location of the irritation.

As in all other matters in dentistry, good judgment is needed to determine in a given case whether it is best to conserve or sacrifice a third molar. The probable influence or effect of each procedure is to be studied. The quality of the tooth-structure, tendencies to decay, the relations of the surrounding tissues, the standing of other teeth in the mouth, are all to be regarded. In every procedure involving conservation, sacrifice, or replacement, the antagonism should have careful attention. Without this thoughtfulness there must be in many instances failure to render the best service.

The points which I would especially emphasize are, first, that upon the inception of trouble with a developing third molar, a decision should be made as to whether the tooth is to be retained or not; and second, if the tooth and its situation are such that its room is better than its presence, it should be removed at a very early stage in its history. Disregard of these sound principles and the evasion of the radical operation, where needed, permits patients to suffer much and unnecessarily, and in some few instances subjects them to extreme risk. Cases are on record of even fatal results from pathological developments, having as a nidus an impacted third molar.

If the tooth is to be kept, the application of the principles of depletion, of derivation, of perhaps counter-irritation and cauterization, or gum-section, with or without local or general anæsthesia, is well understood. It cannot be said that the entire list of remedial possibilities is often so speedily and completely successful as we could wish; but in the cases in which their employment is indicated, patience and persistence should ultimately attain the desired end. If the second molar is a bad tooth, while there is a prospect of the third molar becoming a good tooth, in good position, if given an opportunity, the second molar should, of course, be sacrified; but I can hardly conceive a case justifying the loss of a good second molar to relieve the trouble incident to the crowded eruption.

An upper third molar in any position is not often difficult to re-

move. A lower third molar, if standing nearly erect in the socket, can in the ordinary case of that kind be gotten away with the forceps, even while yet entirely covered with the gum. The difficult cases are mostly of malposed lower teeth, and these are most frequently inclined forward so that the coronal surface presents more or less directly against the distal surface of the second molar. I have seen a jaw in which a lower third molar was occupying a position directly transverse and horizontal; but any such marked deviation of position is extremely rare.

When once the decision is made that the comfort and well-being of the patient would be favored by the absence of one of these bad third molars, it should be removed with such heroism of operation as the case requires. If the ordinary instruments and procedures for extracting teeth cannot be brought to bear, or will not answer, it should be made such a surgical operation with such appliances as will suffice. The extent and difficulty of these operations are not out of proportion to the seriousness of the troubles to be relieved; and dentists are the ones to operate. The instruments and the details of the operation are to be determined by the peculiarities of each case. Ordinarily, the more difficult of these operations are not to be undertaken without that deliberation and control which are commanded by full etherization. Notwithstanding the patient's inability to open the jaws more than a small fraction of an inch, full opening of the mouth is rarely difficult to accomplish under ether with lever- or screw-power, and a firmly fixed prop seems to retain the opening.

For a third molar, tipped forward and impinging firmly against the distal surface of the second molar, a most helpful next step is the freeing all of that contact by grinding from the third molar with a corundum disk with the engine. This very greatly facilitates the extraction of the third molar, and effectually guards against the deplorable accident—which has occurred—of extracting both second and third molars in the effort to remove the third. The frequent backward curve of the roots of the lower third molar is to be remembered. With the anterior surface free simple lever-power, cautiously applied with a suitably-shaped elevator, may suffice to dislodge the tooth, or to so break up its attachment that the after-removal is easy. Sometimes the process at the sides and overlying the back of the tooth is so thick and strong as to hinder grasping the tooth with a forceps or to prevent its being lifted,—a condition of things particularly embarrassing when the tooth is frail, deeply-decayed, tunnelled, and brittle. In such instances, after suitable

dissection of the soft tissues, the bone should be cut away with sharp engine-burs until the difficulty is overcome. Considerable experience has confirmed the conviction that ingenuity and an earnest persistence on the part of the operator, with co-operation on the part of the patient, may surmount the difficulties attendant on the removal of almost any third molar.

However, in these operations well applies the whole of the injunction, "Be bold, be bold, and everywhere be bold; be not too bold." Undue violence, laceration of the soft tissues, and fracture of process, as well as more serious accidents, are all to be guarded against. Any small, loose fragments of process are to be carefully removed, ragged borders are to be ground smooth with corundum stones, and the gum, trimmed with curved scissors if necessary, pressed to overlie in the position most favorable for repair. The patient should understand that one of these operations is very different from an ordinary tooth-extraction, and that the process of recovery, as after any other surgical operation of like extent and involvement of tissue, must take time, and is hardly likely to be free from suffering. Any considerable fracture of process is usually followed by much pain, continuing about a week, and requiring the use of local, sometimes general, anodynes. For the relief of soreness and control of tendency to inflammation, I know of nothing better than very frequent application of the fluid extract of calendula in considerable dilution with water, or fluid extract of hamamelis in full strength. Fetor or tendency to sepsis may in some instances require correction by appropriate means.

Besides such accidents as are possible in tooth-extraction generally, there is in the case of the inferior third molar the peculiar possibility of such injury to the inferior dental nerve as may result in temporary paralysis, or even lasting modification of its functioning. I have seen one such case. It occurred in my own practice in 1874. The very difficult extraction, under ether, of the crooked, hook-like roots of the right inferior third molar for a young lady was followed by loss of sensation in that part of the face. Never having then heard of any such experience, I shared in the patient's anxiety; but, reasoning from the undesired restoration of function after a time following designed simple section of the inferior dental nerve for neuralgia, I felt justified in assuring her that I believed sensation would be restored and that she would be able to note its return in about six weeks. After that interval she did begin to have some prickling sensations comparable to those felt when a limb has "gone to sleep," as the popular experience is; and

very slowly some slight further improvement took place till it ceased to be much thought of; but now, after sixteen years, there has not been a return of perfectly normal sensibility. There has never been any motor paralysis or deformity of expression.

Quite an interval elapsed after this operation of mine before I could find that any one else had had a like experience. Mr. S. J. A. Salter, dental surgeon to Guy's Hospital, in his very practical work, "Dental Pathology and Surgery," published in 1875, gives almost all that I have ever been able to find in print in relation to the subject. On page 354, after expressing his surprise that the text-books of the profession did not make mention of such casualties, he proceeds to describe four cases occurring in his own practice, and he makes allusion to four other cases met by Mr. Bell, and one other by Mr. Holden. The outcome in Mr. Holden's case is not stated. In all of Mr. Bell's cases and in three of Mr. Salter's there was within a short time a return of perfect functioning of the nerve; "and this," he says, "must be considered as the ordinary sequence of the accident." Of Mr. Salter's other case he says, "About six weeks afterwards the patient came to me, and at that time there was scarcely any return of sensation. Six months having elapsed I again saw him; he could then feel when the skin of the lips and chin were touched; but it was not a natural sensation, being a feeling of 'formication,' or what is popularly called 'pins and needles.' From that time to the present he has been often under my hands, and I learn that sensation of the parts has never been completely re-established." That was after an interval of ten years, and the manifestations and history correspond with those in the case of my patient.

The paucity of the literature is evidence that experiences of this kind must be extremely rare,—so rare that the possibility of their occurrence should not debar us from using all reasonable means, with caution of course, to remove impacted lower third molars which are the source of suffering.

[The essayist described several cases of extreme suffering relieved by appropriate treatment of offending third molars, and exhibited a collection of such teeth extracted, showing various peculiarities.]

DISCUSSION.

President Seabury.—The matter is now open for discussion and general remarks.

Dr. Chandler.—This matter of the non-appearance of the wisdom tooth is, I think, very common, and getting to be more so

every day. I have seen quite a number of instances among my patients where it had never appeared, and in many other cases there was a sort of a beany look to the tooth which seemed to indicate a want of development. I myself have had but three of my wisdom teeth, and those were extracted very shortly after appearing. It also seems to me that the lateral is disappearing in the same way. I have seen quite a number of instances of it, and I remember one patient where the upper six-year molars were extracted on both sides in the usual routine way practised almost universally some years ago. The lady never had the laterals, and the consequence was that the upper centrals shut inside of the under teeth. When she came to me she was about thirty years of age, a young lady in society, and quite sensitive as to the appearance of her teeth. I began a course of regulating, and succeeded in getting them to bite square, but I was never able to do anything more, as she gave it up there, being satisfied with what she had gained.

With reference to the rank of the wisdom tooth in the tables which Dr. Brackett has read from Magitot and Hitchcock, I think there is a fallacy in those tables that has not been noticed, and that is, that the wisdom teeth are twelve years younger than the first molars, and consequently have twelve years more chance. To reckon the comparative durability of the wisdom teeth without allowing for this advantage is not just. The canines come after the six-year molars, then the twelve-year molars, and the eighteen-year molars; and there are hundreds of first molars extracted before the third molars make their appearance. It is just so with the hair and the whiskers,—the color of the hair always turns first, and you will find it so universally; apparently it is the difference in the age.

Dr. Fillebrown.—Perhaps Dr. Brackett would like a little company for his cases of paralysis. Some six or eight years ago a lady, who had been a patient of mine for a long time, came to me with a left inferior third molar crowded, and with much inflammation in the parts around it. It seemed best to extract it. I experienced no difficulty in performing the operation, had no hesitancy in deciding that it was the best thing to do, and there was no reason to expect injury to result. A decided paralysis of the inferior maxillary nerve followed, and, with little improvement, has continued to this day. In the whole left mental region of the face sensation is considerably less than normal. There was also a little motor paralysis, which has almost disappeared, but the sensory paralysis re-

mains. It is not serious, only uncomfortable, as Dr. Brackett remarked in regard to some of his patients. I can fully corroborate the statement of Dr. Brackett with regard to the irregularity which the third molar causes when there is lack of room. I have observed it in a number of cases where the teeth, before the eruption of the third molars, were entirely regular in front, evenly situated, and the cuspids properly in position.

When the third molars did appear, the incisors became irregular and remained so. I have seen that in four or five different cases, and it has seemed to me that if the third molar had been taken out a little sooner there would have been no trouble of that kind. This effect of the third molars is more marked in the lower jaw. I do feel that there is a tendency to an elimination of the third molar. I am not fully up on the doctrine of evolution. Its general principles I believe in, but whether a man is an ape or not I am not fully decided, though a good many of them act like it.

I don't know whether evolution would be able to take a tooth out of mankind, or whether we would have to wait until some higher order is developed from this lower order which we call man. One thing we know that, going back among animals, we find that a complete set of teeth numbered forty-four, and, as I understand it, there have been eliminated in all twelve teeth, leaving thirty-two for the animal man. I suspect that these eliminations have been controlled by necessity. A thing that is not needed is very apt to cease to exist. You let a race go on for generations and not use a hand or an arm, or any other part of the body, you would find the unused member growing smaller, and eventually it would cease to exist. In our higher civilized races of men the necessity for teeth is not so great as it was among the animals that had forty-four, so the tendency is to decrease the number. If the number of a complete set of teeth has been decreased by twelve down to thirty-two, I see no reason why it should not be still further decreased to twenty-eight, and I believe that that is the tendency.

I was interested in these cases of impacted third molars that Dr. Brackett mentioned. I have had several cases of this kind, but have very seldom found it necessary to remove the second molar; in fact, I remember of but one case where I thought it necessary. In several instances I have ground off the third molar, as Dr. Brackett has represented. In other cases I have ground it a little, impacted rubber between it and the second molar, and gradually moved them apart so as to raise the crown of the third molar by that of the second. I would say that I have generally

used the Physick forceps for extracting the third molars; and usually it will elevate them from their position remarkably quick and easy. A while since I had a patient who needed to have an upper third molar extracted. Within two years two dentists (I was one) had expended their full force upon the tooth, using the ordinary forceps, without being able to move it from its position. Subsequently I ventured to use the Physick forceps. It was the first time I had used it in the upper jaw, fearing the breaking of the tuberosity. It was one of the greatest successes of my life. The tooth was removed with ease, and there were no signs of fracture. The patient was a surgeon, and understood the difficulty of the operation, and we were both much pleased at the result.

Dr. Meriam.—There is such a judicial character about all of Dr. Brackett's work that we can hardly hope to improve upon it. One case that I have had, and which I have spoken of here before, was very much worse than anything which he has mentioned. It was a case of impacted third molar, where the tooth was inclined so much that the distal surface was uppermost, and doing duty as a grinding surface, and the anterior cusps were locked behind the sound molar beneath the gum. I did what I have never heard of being done before,—drilled into the tooth far enough to employ arsenic to destroy the pulp, then with a hard rubber and corundum disk made a cut just in front of the distal cusps as far down as possible, then with a fissure bur, with end sharpened like a drill, drilled through to the membranes beneath. I drilled standing at the back of the chair and drawing the cheek back as much as possible. I followed the first drilling with a safe-end fissure bur of the right size, and, cutting laterally, soon removed a section representing fully a third of the crown; the tooth was then removed without difficulty, greatly to the satisfaction of my patient, for the tooth had distressed him very much, and its extraction had been dreaded both by himself and practitioners who had seen it. I include myself especially in the timid ones. But one morning the spirit moved me, and I "was bold." We can, I think, save much suffering by first destroying the pulps of teeth we are to grind or divide, previous to extraction.

Dr. Briggs.—It would seem that any one, after listening to Dr. Brackett's admirable paper, would have to be possessed of considerable temerity to announce a different method, but I have had cases of impacted third molars where I have extracted the second molar and produced good results. I have a very high opinion of the third molar, as high as of any tooth in the mouth, and I think that its

faults are due to its environment,—that it is more sinned against than sinning, and that placed as far forward in the mouth as another tooth, it is as good a tooth as we have, but being placed as it is, with the cheek lying upon it, thereby rendering it impossible for the brush to reach it and keep it clean, it of course decays rapidly and becomes troublesome. In those cases, I think, oftentimes the third molar should be taken out, and I do extract them.

In cases where they erupt almost completely, but do not come up entirely, because they meet the upper molar and the bite in the angle of the jaw is so short, I have seen considerable suppuration around the tooth which I have supposed was due to a pocket between the gum and the tooth caused by the non-attachment of gum to the enamel. In some cases I have cured it by grinding an upper or lower molar until it could erupt further. When it is advisable to make more room to prevent the third molar from crowding, I have had cases in which I have taken out the second molar. In those cases of the third molar erupting a very small portion of its crown accompanied with a great deal of pain of the neuralgic sort, spreading about the jaws and the head, I have extracted the second molar, and in all the cases that I have so done, the neuralgia has been cured, and the third molar has swung into line perfectly, and has been an excellent tooth, as good, if not better, than the second molar, and I have also found in most of those cases that the second molar was more or less injured by the impact. It had become absorbed at the point of contact, hollowing in so as to make a shoulder,—a place away down out of the way,—which would, in the future, produce a cavity capable of quickly reaching the pulp. This fact has added to the causes of my congratulation at having taken out the second molar.

Dr. Fillebrown.—I can keep Dr. Briggs company in his view of the matter. One case presented itself to me not long ago in which I extracted an impacted third molar with great difficulty. I had to grind away the tooth and use rubber to separate, and it took a long time before I could get at the tooth to extract it, when, lo and behold! the distal surface of the second molar was a nest of decay. If I had taken out the second molar, it would have been a great deal better for the patient and have saved us both considerable time and trouble.

Dr. Andrews.—I recall one or two instances in which the extraction of a third molar gave me a good deal of trouble. Twenty years ago I had a case in which I broke the points of two pairs of forceps and spent nearly two hours in trying to extract a wisdom

tooth,—and strange to say the gentleman is still a patient of mine. The tooth inclined forward, and was butting against the twelve-year molar, and was entirely under the gum.

I tried quite a while to get hold of the tooth, but the instrument would slip. Finally, with the engine, I drilled a couple of holes to hold the points of the cow-horn forceps, and was able to extract the tooth. This method is not original with me; somebody told me of it. In this case it worked admirably.

Dr. Williams.—I was very glad to hear in Dr. Brackett's excellent paper that he does not absolutely condemn the wisdom tooth. Patients often say, when I have spoken of filling a cavity in a wisdom tooth, Is it not better to throw it away? But I tell them I have seen wisdom teeth outlast all the others, and sometimes become valuable supports in retaining artificial sets. There are several things about them in which they differ from other teeth, and one thing that I have noticed is that the dentine is apt to be more sensitive than the average of dentine of the other molars, in fact, nearly resembling pulp sensitiveness. My attention was first called to it through an experience of my own. I had considerable trouble with an upper left wisdom tooth, and, like many of our patients, I bore it for a week or two before I decided to have it attended to. I thought, from the sensation, that it was the result of pulp exposure, and made a statement to that effect to the dentist to whom I applied. He, having a slight opinion of wisdom teeth, said that it had better come out, and out it came. On glancing at it, we found that simply the enamel was decayed through. It was the dentine which had given me all the trouble, and I have since found in wisdom teeth that the sensation of the dentine often is very similar to the sensation of an exposed pulp, therefore I make that allowance always.

As Dr. Briggs has said, the wisdom teeth are sometimes the cause of general neuralgia. I remember a patient, a lady, who had been treated six months for neuralgia, and she repeatedly suggested that the teeth might have something to do with it, and finally decided to have them extracted. She came to me, and I saw that they were very important teeth for chewing, but the pulps were exposed. I told her that very possibly her neuralgia came from them, and that if she had plenty of teeth she might be able to do without the troublesome ones, but that, under the circumstances, I thought it would be better to fill and save them. She consented, and those teeth lasted her for years. The physician had to stop his treatment, as the case ended as far as it required medical treatment. I do not know but that they are still in her mouth.

In regard to those cases where the wisdom teeth impinge against the second molar I have had some very complicated cases and, of course, have had my experience in trying to extract them. I, too, have tried the grinding process. In some cases, by a very slight grinding with a diamond disk, I have obtained just the chance, if there was no chance before, to pack some cotton between the second and third molars, then I have put a waxed tape between them, after that perhaps increased the folds, so that the tooth as it grew and pressed against the other tooth would have a chance to slide up. In several cases there has been success in this way.

Dr. Chandler.—Speaking of the evolution of the wisdom teeth out of the jaw, I have one case where it seems to be evolving the other way. The patient is a man fully fifty-five years of age, and he has six wisdom teeth, two of course being supernumeraries. Four of them are in the lower jaw, and they are all perfectly formed and in good condition, and he has a very good set of teeth otherwise, and a pretty large jaw. There they stand and are likely to stand until he dies. It is the only case of the sort that I have ever had in my practice.

Dr. Andrews.—I spoke of a case of that kind at our meeting in Cambridge, in which there were four extra teeth, making eight wisdom teeth in one mouth. I gave the name of the patient—a lady residing in Tiverton, R. I.—to Dr. Brackett, thinking he might have an opportunity of seeing this remarkable case.

President Seabury.—Since our last meeting I extracted a wisdom tooth for an old lady who must have been certainly seventy-five years old. She had an upper set of false teeth. It showed but a small point at the surface, but I got out as perfect a tooth as I ever saw. The roots were straight and unusually long.

Dr. Hitchcock.—I would like to relate a peculiar case I once had of a wisdom tooth, which I came across in connection with Dr. Werner. The patient was a lady of about sixty-five years of age, who wore an artificial upper denture. The trouble began by a swelling away back in the mouth on the right upper side, followed by a discharge of pus. Examination with a probe resulted in finding, about three-fourths of an inch up, a hard substance, which moved, about readily, being surrounded by more or less dense bone. This substance, on being removed, was found to be a nodule, covered with enamel, evidently a partially-formed wisdom tooth.

Dr. Stevens.—I would like to say just one word, and that is with regard to extracting those lower wisdom teeth. I think if Dr. Brackett had an elevator similar to one which I have, he could

have extracted the tooth of which he spoke without breaking it off, or without being obliged to put the patient under the influence of ether. An examination will show the wisdom tooth to hook backward, and therefore the force to be used in extraction should be applied in a way to unhook it. The elevator that I use is an ordinary elevator, so small as to be carried down between the tooth and the socket,—not using the twelve-year molar as a fulcrum at all, but using ordinary force in pressing it down, and then lifting it and turning it backward to unhook the tooth, and in this way they can be taken out remarkably easy. It is called the Coolidge elevator. I think Dr. Andrews has one. It is made with a large and long handle, and is so well adapted for extracting the wisdom tooth that I seldom use the forceps.

Dr. Banfield.—I would like to ask Dr. Brackett if he has noticed any disturbance of the wisdom teeth similar to that of a patient of mine? A young man of about twenty-four years came to my office, saying that he had been confined to his bed for nearly two weeks on account of supposed disturbance of his wisdom tooth. An examination found his teeth in good condition, but around the right inferior wisdom tooth the gum was considerably inflamed, which he said had given him much trouble; but the most peculiar feature was the dark-red color of the free margin of his gums, for one-eighth of an inch all around on both the upper and lower jaws. I have recently had a few cases of disturbance of the wisdom teeth, complicated with severe gingivitis, that made its appearance at the same time the patient was afflicted with la grippe.

President Seabury.—The next business is "Incidents of Practice and Presentation of Specimens."

Dr. E. G. Tucker exhibited a case of crown- and bridge-work that he inserted in a lady's mouth in 1844, and which was worn with satisfaction forty-five years, until 1889. The teeth were porcelain, carved, single teeth (left upper central incisor and right and left upper canines), set on gold plate, with gold pivots attached, and the three gold pivots were inserted into the hickory pivots which had previously been placed in the roots.

Dr. Meriam.—Mr. President, I present here some fine platinum and iridium tubes. I had them made some twelve or more years ago, and showed them at some of the society meetings. I do not think their value was understood at that time, for they received but little attention. The number of small syringe-points that are used now make me think that they are worth speaking of again. I have them here on a card just as they came back from the Min-

neapolis exhibit of 1889. They are useful for hollow posts and in making pieces for regulating, and for fine syringe-points. The smallest size is smaller than the finest tube now offered for sale; it telescopes into and can then be hard-soldered into the next larger size, this into the next larger, and so on, allowing for the making of a great variety of points. A foot of this tubing costs but a trifle. I gave my directions for making to Mr. George A. Warren, No. 7 Tremont Row, Boston. I did not, in the language of the trade journals, suggest them to him, and any one who wishes can order them made by him. It would be better, perhaps, for those at a distance to find some good workman, and after instructing him in their making, report his name to the dental societies in the vicinity, so that a greater number of practitioners will know how easy it is to obtain them.

Dr. Williams.—I have had several of them made, and I have found them very useful.

THE regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms, December 3, 1890. President Seabury in the chair.

The paper of the evening was read by Dr. George F. Eames; subject, "The Obtunding of Sensitive Dentine."

THE OBTUNDING OF SENSITIVE DENTINE.

BY GEORGE F. EAMES, M.D., D.D.S.

The dentist who has just used an excavator in removing a little superficially decayed dentine finds an immediate response from the patient, who informs the operator that he has "struck the nerve." The dentist kindly explains that it is only "sensitive dentine," at a considerable distance from the nerve itself. If asked, "What *is* sensitive dentine?" the practitioner will say, if well read in all the modern literature pertaining to this subject, "I do not know; I can only designate it by certain phenomena consequent upon irritation of this structure. We all know that it is often sensitive or painful when touched, and we name the condition from this symptom alone, because we have no real knowledge as to the *modus operandi* or mechanism by which pain is induced, or of the peculiar condition of the parts involved which permit these phenomena."

In recent years pain obtundents and local anæsthetics have been introduced in great profusion, while there is a scarcity of literature which considers the physiological and pathological basis upon which anæsthetic agents may be used. This indicates that the general practice is largely empirical, and this impedes the progress of the profession.

It is time now to ask why the obtundent obtunds and how it does it. Allow me, if you please, to refer to the anatomy and physiology of tooth structure only in sufficient measure to be of assistance in more clearly elucidating the subject. We are to speak principally of the dentine which forms the main bulk of the tooth, and within which is a canal or canals with the largest diameter at the pulp. At the periphery of the pulp and the dentine is a layer of odontoblastic cells which send prolongations into the dentinal tubuli.

This description is, in substance, I believe, generally accepted, although, like other anatomical structures that are microscopic, it may be questioned. Magitot, for instance, denies the existence

of these odontoblastic cells, holding that the dentinal fibril is a continuation of a layer of reticulate cells which lie beneath the odontoblasts, while Klein maintains that the only office of the odontoblast is in the formation of the dentine matrix, the dentinal fibril being a prolongation of cells originating between the odontoblasts.

All must agree, however, in the existence of a protoplasmic material throughout the entire structure of the dentine, giving it both nourishment and sensation. We say sensation: *why* do we say it? Is the dentinal fibril capable of transmitting sensation? Let us see. The functions of the dentinal fibril, the various influences that may affect it, its relation to the tooth-pulp, may well form the principal subject-matter for our study in sensitive dentine, for it seems only reasonable that, whatever may be the method of conducting painful sensations from the dentine to the brain, this living matter in the dentine must be the *medium* through which it reaches the pulp. The sensation of pain having reached the pulp, we readily see how it may be conveyed to the brain by reason of the well-known function of the sensory nerves; but the dentine has no nerves; this protoplasmic material occupying the dentinal tubuli has not been shown to be nerve-structure. How, then, may it be the medium or have the power of transferring sensations?

We have already noticed the very intimate relations existing between the odontoblastic prolongations or dentinal fibrils and the pulp. Let us now notice some of the characteristics of this so-called dentinal fibril. For this purpose we have recourse to some of the simplest forms of life, and from them receive valuable knowledge, as Paget so admirably writes: "The highest laws of our science are expressed in the simplest terms in the lives of the lowest orders of creation." These odontoblastic cells forming the dentinal fibril seem to consist of simple masses of protoplasm, of which the amœbæ and the leucocytes are good examples, all possessing similar characteristics, so that we may draw reasonable conclusions from them. The amœba may be easily observed under the microscope. We find that it is capable of moving with extreme slowness from place to place; that it is sensitive to mechanical and chemical irritation, as shown by the change in its movements and in its form. It is especially sensitive to thermal changes. If the temperature be raised to 95° or 100° F. the movements are arrested, but if this amount of heat be not sustained too long, the amœba will resume its power of moving. The same thing occurs when the temperature is reduced to the freezing point. If the temperature is reduced

below the freezing point or raised above 105° F., the movements entirely cease and are not resumed on raising or lowering the temperature again; in other words, there is cessation of function, —the amœba is dead. This is the effect of heat and cold upon protoplasm, as shown in the amœba, the leucocyte, and, with possible modification, in the dentinal fibril.

These results suggest the possibility of painful sensations being transmitted to the pulp and thence to the brain through the agency of the fibril. They also suggest the possibility of injury to the pulp by means of hot or cold applications to cavities in the teeth. If this theory be true, then in every cut into the dentine with the excavator we are wounding living tissue, and this irritation is converted into pain when it reaches the pulp.

But my main purpose in calling your attention to the anatomy and physiology of the dentine is that we might better understand the effect of heat or cold as applied to sensitive dentine. Heat is applied in various ways, dry or moist, but one of the recent methods of using moist heat is that in which a jet of steam is applied to the cavity; others consist in the use of a spray from a very volatile liquid like chloride of methyl, bromide of ethyl, or ether. In the use of these agents, as well as steam, the heat or cold is intense, and it seems to me that, in making use of such extremes of heat and cold, we may be expecting too much of the vitality of the dental pulp. The protoplasmic cell, identical in its nature with the dentinal fibril, is destroyed at a temperature above 105° F. or below 32° F.

The dentinal fibril being in such close connection with the pulp, and perhaps through it in some way fortified with an extra amount of vital force, or resisting power, may be able to recover after the application of a greater amount of heat or cold than a portion of isolated protoplasm. However this may be, in the light of the foregoing statements I am bound to say that I believe there is danger in the general use of such extremes of heat and cold as are produced by the spray of ether or chloride of methyl.

I am fully aware that these agents are used in a large majority of cases, as I have used them myself without perceptible injurious results at the time, and I believe that what has been written advocating these remedies is in the right direction, but I do not think sufficient time has elapsed to enable us to judge correctly. An application of steam two seconds longer in the case of one patient than in another may be enough to make the difference between success and failure. It seems to me that such nice adaptation to

the temperament of an individual cannot always be made by ordinary mortals.

Now, I am sure that we can make use of heat or cold in sensitive dentine without injurious results, and in this way: By using an apparatus which will indicate the temperature; in other words, by knowing the dose to be administered. The method which I wish to commend, and which I believe can be used in the greatest number of ways, is the use of warm air at a certain definite degree. If we are to be guided at all by our observations of the effect of changes in temperature on the amœba, we shall not raise the heat above 110° F. or reduce it below the freezing point. I am sure that I have accomplished much with this degree of heat, although I do not pretend in any dogmatic sense to fix the border line beyond which we cannot use heat or cold with safety.

I have recently been using Codman & Shurtleff's air-compressor, and have had several appliances made to connect with it, heating the air, still under pressure, and conveying it to the mouth, and by means of a valve and fine tube having it under full control. My last apparatus was an air-tight brass tank containing a thermometer, which indicated correctly the temperature of the air *in the tank*, but very hot air in passing through six feet of rubber tubing will become cold.

I am experimenting with a much smaller instrument, which can be placed on the bracket table and brought near the patient.

Air, under pressure, made warm at will, may be made to serve many useful purposes besides obtunding pain. It is the very best means of producing a spray from any liquid, and there are many uses for the spray. Hot medicated air may be driven with great force if desired into a root-canal, or used as a chip-blower, or to hasten the hardening of modelling composition when used for impressions of the mouth, to soften gutta-percha fillings or crown-settings, etc.

Permit me now, if you please, to indicate something in the line of treatment, according to my view of the situation. We may find a condition of general or local nerve irritability, or both. I sometimes treat systemically, using laxatives if needed, followed by such sedatives as sodium bromide, Jamaica dogwood, or aconite, avoiding the menstrual period when possible, and give morning appointments as a rule.

A combination of kindness, patience, mesmerism, hypnotism, Christian science, mental healing, magnetism, sharp instruments, and a steady hand is always on the shelf for use, and I see no an-

tagonism or incompatibility between the ingredients. For the local and the general condition in excessively sensitive dentine, the inhalation of ether has been with me a decided success. The patient usually holds the napkin and inhales until the first effects are produced, stopping short of unconsciousness. The odor is an objection, of course. I do not use it often, but when I do it is to me the king of remedies. I have frequently used nitrous oxide for this purpose with much satisfaction. But cocaine is the remedy that I use most, and I believe it to be the safest and most efficient local anæsthetic that we have at our command to-day. This is the way I use this agent and succeed: After the cavity is dry I make it dryer by the use of warm air; the dehydration of the tubules and the raised temperature not only lessen the sensibility, but also provide for the absorption of any medicament that may be placed in the cavity. Alcohol is also used for drying, alternating with the warm air until I think it sufficient for the purpose; it is then ready for the cocaine. I formerly made an alcoholic solution, but believe it to be better practice to use the cocaine and alcohol separately.

Our studies in experimental therapeutics show that alcohol is absorbed very slowly if at all, while acidulous and chloroformic solutions are absorbed with facility. I therefore have used chloroform alternating with an aqueous solution of cocaine, although I now make my solution of cocaine in chloroform alone. The dentinal tubules being deprived of moisture by means of alcohol and warm air, now readily drink up a chloroformic solution of cocaine.

I have used this method with the above modification with decided success. I think it is believed by the profession generally that cocaine is of little value in sensitive dentine, and I had reached this conclusion myself; but a physician once insisted upon my using it in his tooth, and he had so much faith in its efficacy from his experience with it in the soft tissues, that I made a thorough application with fair success; later I became interested in experimental therapeutics, resulting in the use of cocaine as I now use it. The only obstacle to its application in and around the teeth is the difficulty of securing absorption. If you can once cause it to reach the spot where you want it to act, it will anæsthetize every time it is applied.

DISCUSSION.

Dr. Fillebrown.—I have been much interested in the paper. My experience with hot air or cold spray has not been extensive, and this because the experience which I have had with them has

not been very favorable. Their application has inflicted too much pain. This is the case with other obtundents, as phosphoric acid, and in particular chloride of zinc. These generally produce considerable pain, but are effective. With cocaine I have had more uniform and satisfactory success than with any other substance I have used. I have had marked successes with it in many cases where one would think it would hardly accomplish anything,—for instance, in buccal or labial cavities where the rubber dam is not applied, but a napkin is laid upon the gum and the cavity made moderately dry. In these cases, without the use of alcohol or hot air for drying, but simply by removing moisture with absorbent cotton, and laying on a piece of cotton saturated with cocaine and allowing it to remain for a minute or two, a wonderful change takes place. The patients themselves will notice it and speak of it. It will not always palliate, but it will do so in a larger proportion of cases than any other agent that I have ever used. I wish also to say amen to the use of the anæsthetic power of ether for obtunding sensitive dentine. I have patients who for a long time have used it whenever they have had an operation performed, and they will not allow me to do anything to their teeth until they get their dose of ether. By taking it to the first stage of anæsthesia, I can cut away and get the teeth into good shape, and the patients do not suffer at all. But for the prejudice against ether on the part of so many patients, I would use it a great deal oftener than I do. If it were not for the prejudice that exists against chloroform, I would use it instead of ether. Chloroform has a pleasant odor, and a very small quantity is effective. Its vapor has not the irritating quality of ether vapor, and it will obtund the sensitiveness of dentine with a less degree of anæsthesia than will ether. I have one patient, a dentist, for whom I have performed operations for a number of years. His teeth are very sensitive indeed, and he invariably takes a little chloroform on a napkin and inhales it; and while he is still conscious and perfectly rational, and can talk and tell me what is going on, he can have the operation performed with perfect ease. I think this matter is worth our attention. The method is perfectly reasonable, and I wish more would try it. Recently I underwent a minor surgical operation. In order not to feel the pain, I took some chloroform on a napkin and inhaled it until I felt all right, and then said to the operator to go ahead. I retained my senses and held control of the chloroform and of myself. I knew what was going on, talked about it all the while, and told the operator that he was not hurting me. The operation was

soon over, and I felt all right in a few minutes. I think the inhalation of anæsthetics to obtund sensitive dentine a practical idea to entertain, and it is worth our while to give it more attention.

Dr. Williams.—There are several points in the paper with which I fully agree. I was glad to hear the rationale of the sensitiveness of dentine so thoroughly elucidated. The matter of obtunding sensitive dentine of course comes to us in a practical way. Some time, perhaps, I will allude in a paper to a system I devised for obtunding sensitive dentine before ether was used. It was not a complicated or dangerous process. It consisted in allowing a simple solution of chloride of lime to remain a short time in the cavity. Then with a sharp instrument, and the sharpness of the instrument was an important factor, you could cut where you could not touch before. This method I have used to a considerable extent since. For the general obtunding of sensitive dentine I have found lime-water effective. Bicarbonate of soda often does the same thing, though more disagreeable to the taste. If patients will simply rinse the mouth with dilute lime-water, not strong enough to be caustic, it is a good application to sensitive dentine.

Speaking of ether, my preceptor, Dr. Keep, was rather intimately connected with some of its promoters, and I had an opportunity to see how it was received by the public. At first it was used very extensively; patients demanded it,—they thought that the day of the millennium had come, that they could take ether while undergoing any operation and be free from all discomfort. There were two or three who insisted on taking ether at once as soon as they sat down, before having the teeth examined, to be unconscious of what was needed to be done. Of course there were very great objections to that, and we often had to use strong argument to convince them that it was not wise to use it so freely. When I opened an office of my own, I discarded ether largely because of the disagreeable odor in the office, which I carried out in my clothes, and which patients carried around with them for several days after it was used. In some cases, too, nausea was produced, which was objectionable.

When chloroform began to be substituted for ether, one or more cases at the hospital resulted fatally, and I have no doubt that if we had not by habit been so very careful in the application of sulphuric ether in Dr. Keep's office, there would have been fatal results from the use of chloroform. We had several cases of collapse, in which there was cessation of breathing in some instances and cessa-

tion of heart-beat in others, and at times it was only by the greatest vigilance that we succeeded in bringing such cases around, and most of them were not the result of a heavy dose. I remember one case as showing the idosyncrasy of some constitutions with regard to the influence of ether. A lady was overcome by ether which was merely unstopped in a bottle six or eight feet from her,—the simple "intimation" of the odor checked the circulation. That, of course, was an unusual thing. I remember a scare which one of our older physicians had in my office. His brother was a patient of mine, and required the extraction of two or three roots which were rather irritating, and he proposed to take ether. They were using chloric ether at that time as a modification of chloroform, and the patient asked if he might have his brother come in and give it to him. I said certainly, I should be very glad to have him relieve me of that part of the care. So the physician gave it, and a few seconds after the extraction the patient collapsed. He fell back and ceased to breathe, his eyes were glazed, and he grew purple in the face, and no pulse could be felt. The physician turned as pale as the brother was purple, and called for ammonia. I told him there was no time for that, there was not a second to be lost, we must get him to breathing *at once*, and I commenced the bellows action of the chest and kept it up steadily, not even stopping to put him into position for working the arms. Very soon his face began to brighten, and he recovered. There is a value to this bellows action, I think, that is not often apprehended. No time should be lost,—not even to get your appliances; the action of breathing forces the heart to act so that the circulation is not fatally stopped.

I agree that aside from these there are other ways of obtunding sensitive dentine, and the use of cocaine, of which the essayist speaks so highly, certainly is of great value. I think that it has been with me the most satisfactory ready obtundent I have used, although I have been disappointed in some cases of very dense dentine. Even those cases generally would be affected; and instead of giving three or four minutes for it to take effect, I would seal up the cocaine in the cavity and go on with some other work for ten or fifteen minutes or more. Sometimes in applying it to the outside of a tooth, I put a piece of paraffine paper over it to prevent its washing away, and let it rest. Time renders the application more effective. In it's application to soft dentine, by mixing the cocaine with lanoline or agnine its absorption is facilitated.

Dr. Eddy.—In connection with this topic I should like to show one of Mr. Small's latest appliances. I do not approve of chloro-

form; I think it is liable to be fatal, and I do not like ether on account of its odor. This instrument is an improvement over the "steam cooker," as Dr. Cooke calls it, which was shown here at one of our previous meetings. It is much smaller than the old one, and is more easy to handle. It consists of a little cylinder containing a cartridge into which is put some cotton saturated with alcohol. This rubber tube is simply intended to keep the heat from the hands. By heating the bulb here the hot air vaporizes the alcohol, and you get a spray of hot alcohol vapor from this point. As there is no lamp with it there is no danger of any explosion. Mr. Small brought it to me about two months ago, and I have used it somewhat, perhaps not as much as I would wish.

Dr. Cooke.—Is Mr. Small selling those appliances?

Dr. Eddy.—I understand he is; I believe the price is fifteen dollars.

Dr. Cooke.—I saw in one of the British journals lately an illustration of an appliance just like that. It was shown in Berlin by a Mr. Simonis before one of the societies there, the price being a few shillings.

Dr. Banfield.—I would like to ask Dr. Eddy if there is anything to make them so expensive?

Dr. Eddy.—Not in the material or cost of manufacturing. I should think thirty-five or forty cents ought to make it.

Dr. Briggs.—I am very much interested in this paper and have obtained several suggestions from it. I simply want to testify to the method by which I obtund sensitive dentine, which has something of the same principle as the essayist advocates. I first obtund the sensitiveness somewhat with a solution of cocaine, and then follow that with a mixture of carbolic acid and caustic potash to destroy the contents of the tubuli. This treatment is very effective.

Referring to the remarks on ether and chloroform, I think we ought always, in speaking of a subject of that sort to those who have not made a special study of their use, to caution them that they are attended with considerable danger,—especially chloroform. I do not use ether because the odor is so very bad. I have used chloroform many times as spoken of here to-night, but I wish to give to others the very strong caution to remember that the state of incomplete anæsthesia is considered the most dangerous state the patient can be in. At that time the heart is slightly enfeebled by the action of the anæsthetic, and if you cause sufficient pain you may by reflex action stop the heart entirely. So that the state

of incomplete anæsthesia is more dangerous than the complete state, where the danger is not to the heart, but to the respiration, the heart beating for several minutes after breathing has ceased, and a prompt means of continuing respiration generally restoring the patient. It is, therefore, important to bear in mind these facts when deciding as to whether you will put a person under complete or incomplete anæsthesia, although ordinarily the pain from a tooth is not sufficient to cause reflex action.

Dr. Williams.—From my observations I think Dr. Briggs's remarks would apply to chloroform rather than to sulphuric ether. My experience with the use of partial anæsthesia has been confined to sulphuric ether, and I have found that it gives the patient a sort of "Dutch courage." I sometimes used it in light operations, as the taking out a small root, and have never had any trouble in its use while producing partial anæsthesia. With chloroform I have seen rather dangerous threatenings.

Dr. Niles.—There seems to be in the profession a general attention to the subject of sensitive dentine. During the past year five or six improved methods and secret preparations have been advertised or presented to us in one way or another. I am of the opinion, however, that the restrictions of sale are such that professional honor precludes many from using them. The appliance which has been shown here to-night I have been somewhat connected with, and perhaps it is best for me to explain just how I am interested in it.

Last spring, as you know, an appliance was exhibited here which was called the "steam cooker." I experimented with it and met with very fair results, but it was very clumsy and unmanageable. I think it was the first instrument of this kind that Mr. Small made. He afterwards made this modification of the appliance, which he brought to me just as I was about to start for Berlin. He desired me to take the appliance along with me. I asked him how he intended to put it on the market. He told me that he had decided to sell them outright at a fair price, also stating that it was patented in America, France, and England, but not in Germany. It was my opinion, and I think I so expressed it to him, that, if the instrument would do what he claimed for it, the profession would be willing to pay him a fair price—at least ten dollars apiece—for the instruments, but that they would not take hold of them at one hundred, fifty, or even twenty-five dollars, as he proposed. I had only a few moments for conversation with him, and he left to my judgment the sale of the instrument in Germany. After show-

ing the apparatus in Berlin, I was invited to clinic. I did so for three consecutive days, and met with extraordinary success; in no case did it fail of the desired result. I had seven patients, all dentists but one, and all of them assured me that they did not experience the least pain in its use, or in the excavating following its use. It was received with a good deal of enthusiasm; thirty-two or thirty-three gentlemen were anxious to be supplied with them at once. Acting upon the instructions which the inventor gave me before leaving this city, I made arrangements with a dental friend in Belgium to fill orders at ten dollars a piece, forty marks. These orders were filled and the inventor approved my action. I have recently learned that, on account of there being no patent on the invention in Germany, the instrument has been reproduced by manufacturers there so as to be sold for six marks. I would not care to use the instrument nor recommend it if its price were one hundred dollars, or if dentists were to get an instrument free by taking a share of stock in the company. In my opinion, it is as unprofessional to rob the inventor as it is to permit him to rob us by encouraging an exorbitant price. I think he is entitled to some credit for having invented the appliance, and that ten dollars is not a high price for it. If we use the invention, the inventor should be paid. I use the instrument almost daily, and am very much pleased with it. It is not always successful; a great deal depends upon the density of the dentine. But in the teeth of children, if kept dry, it acts very quickly and effectively. With adult teeth the action is slower, and often produces considerable pain before the sensitiveness of the dentine is controlled. An application of a few seconds is often all that is necessary to produce complete insensibility to pain in very sensitive teeth.

Dr. Ainsworth.—I should like to ask Dr. Niles if in the use of this instrument or the one that preceded it he has ever had any unpleasant results on the pulp?

Dr. Niles.—I have never used it where a tooth was decayed near the pulp, and have never seen any bad results, or known of any, from the use of this instrument.

Dr. Ainsworth.—It strikes me that this is a great improvement over the other. I used the other instrument a few times, but with very little satisfaction, and I was informed of a case where there was a good deal of trouble apparently from over-cooking the pulp. That happened at a clinic, but it seems to me this instrument could be handled more easily, and would therefore be free from as much danger.

Dr. Eames.—In regard to the steam obtunder exhibited by Dr. Niles, I have not heard it stated here just what it is that obtunds. I suppose, however, its virtue is wholly due to the temperature established in the dentinal fibrils. I have a jeweller's blow-pipe about eight inches long that acts on identically the same principle as the instrument shown here this evening. There is a wick saturated with alcohol enclosed in the pipe. If you heat one end of the tube, the vapor comes forth in a jet. I see nothing new in principle, simply a new use of the principle.

I have the pleasure, through the courtesy of Messrs. Codman & Shurtleff, of showing you their new compressed air-tank, the instrument to which I referred in my paper, and by means of which we can have air on tap at any desired temperature. Here is the air-pump with two cylinders and a gauge. Any desired pressure can be obtained, and just by the touch of the finger the air can be let out at the syringe-pointed nozzle. The air is not warmed in these cylinders, but in a separate air-tight tank connected with this. I did not bring that with me to-night, as I have not had time to complete certain improvements that I am making in it. In order to secure a favorable condition for the absorption of cocaine in the hard, dense teeth of elderly persons, I use more of the warm air. I had a case this afternoon where I used warm air exclusively with good effect, applying a continuous stream for a considerable time.

Dr. Briggs.—Would it be possible to warm the air in the tank?

Dr. Eames.—Yes, but if you use a very long tube, especially a rubber tube, the air will get cool before it reaches the end, and you do not have the same temperature as in the tank.

Dr. Briggs.—Does it not require a pretty large chamber, so as not to allow the air to cool?

Dr. Eames.—Not so large as I at first supposed. A tank the size of a quart is sufficient. I could let air very rapidly into the tank through an orifice a quarter of an inch in diameter, and it would become heated as fast as it entered. Small metal tubing heated at one point will warm the air sufficiently, even though the air passes rapidly through it.

Dr. Fillebrown.—At what temperature do you use the air?

Dr. Eames.—In view of the theory that I have advanced, 105° Fahrenheit should give the best results.

Dr. Fillebrown.—I have been using for a long time cocaine and chloroform separately, but I should think that a solution of cocaine in chloroform might answer the purpose just as well.

Dr. Eames.—A ten-per-cent. solution makes a very good mix-

ture, and is fairly clear, as you will see by the bottle I have just passed around. I have used this solution only a few times; I am in the habit of using warm air to quite an extent, raising the temperature of the tooth and removing moisture from the dentine. I then use absolute alcohol and then dry the tooth. I next apply the solution of cocaine, and afterwards apply chloroform on cotton to hasten the absorption of the cocaine. This process to be repeated when necessary.

With regard to the state of partial anæsthesia being a condition of danger, it does seem a reasonable conclusion when we remember that the nucleus of the fifth nerve and the nucleus of the pneumogastric are very closely connected. A peripheral injury, therefore, referred to the fifth may be transmitted to the cardiac branch of the pneumogastric and paralyze the heart. Still I have used partial anæsthesia very generally, and have never had any serious results.

As to the injection of cocaine into gum-tissue, to obtain good results these are the requisites: A sharp needle and a good syringe. Inject the solution with considerable force until the tissue turns perfectly white for a considerable distance about the tooth. When this effect is produced in every case the tooth can be removed without pain.

Dr. Briggs.—May I ask Dr. Eames how much he injects, and of what strength?

Dr. Eames.—Of a four-per-cent. solution I usually use from five to ten minims, and a proportionate amount of the stronger solutions; that is, upon the average patient. There are those who may be susceptible to a less quantity. In the injection of cocaine into gum-tissue I am mindful of these facts: The dose by the stomach is one-eighth grain to three grains; under the skin, two minims of a four-per-cent. solution. In injecting into the gum, however, much is wasted and some is probably carried off by the hemorrhage which follows. We may therefore expect that a comparatively small portion of the dose enters the circulation. It would be a far different matter if the needle should go below the gum into the vascular tissues at the junction of the cheek. In such a case a very sudden and profound effect might be experienced. Provided the whole amount were sure to go into the circulation, two minims of a four-per-cent. solution should be enough for the first injection, in case the patient has never had it used before.

Dr. Briggs.—I got constitutional effects the other day from a twenty-per-cent. solution of cocaine passed down around the root of a molar tooth that I wished to scale thoroughly, not using the

hypodermic syringe, but simply bathing around the root. The patient seemed to be very susceptible, but of course that is a somewhat stronger solution than one would inject.

Dr. Williams.—Cocaine is one of those things that seem to act differently on different constitutions. You cannot make a machine thing of it,—cannot always calculate what the effect will be.

Dr. Eames.—I would suggest that every one should know the physiological antagonist of cocaine. Nitrite of amyl is the antidote. The best form for use is the pearls, which are little glass capsules, and are simply broken, crushed in a handkerchief, and inhaled. No one should use cocaine without having the antidote at hand.

President Seabury.—I would say that, for the last six years at least, I have been using for sensitive dentine, especially in the teeth of children, a little atomizer with which I spray ether. I feel sure that I can take up my atomizer and obtund the sensitiveness of the tooth and excavate it and get through while you are getting these things ready. In my hands it is very uniform. A half-minute's application of the spray of common sulphuric ether into a cavity is very effective. You have the atomizer right at hand; use it and get through with it, and that's the end of it.

Dr. Brackett.—Do you use an ordinary atomizer such as you would use for perfumery, operated by an elastic bulb?

President Seabury.—Yes; direct it right into the cavity and spray it there for, say, half a minute, put it down, take up your excavator, and cut off that sensitive layer. It can be used with or without the rubber dam.

Dr. Stevens.—I should think the ether would be likely to dissolve the rubber dam.

President Seabury.—I haven't noticed that it does; it would hardly do it in so short a time.

Dr. Taft.—In excavating around the gums in labial cavities, on the incisors, for instance, you would not use it without protecting the gum, would you? Would it not freeze the gum?

President Seabury.—I never freeze the gum. If the margin of the gum begins to turn white I stop,—that is enough. You need not have as much as that, even; it hasn't to be carried to that extent. Any man who uses it will become familiar with it and know exactly when to stop. My rule was, when I first began to use it, to apply it until I saw the margin of the gum begin to turn white; but now, where I do that once, I use it ten times without, and with as much uniformity of result as in any other

operation. The beauty of it to me is that it is quickly done and over with.

Subject passed.

Dr. Eddy.—I have here a very neat blow-pipe which I found in a jeweller's supply store. I bought it of the Waterbury Brass Company, Providence, and presume some of the jeweller's supply stores here have it. Price, $2.50.

The American Academy of Dental Science held its regular monthly meeting in the Boston Medical Library Association rooms, October 8, 1890. President Seabury in the chair.

The paper of the evening was read by Dr. Wm. H. Potter, subject, "Creolin."

CREOLIN.

BY DR. WM. H. POTTER.

All antiseptic drugs are of interest to the dentist. Though there are several antiseptics whose reliable qualities have been thoroughly proven, yet each one possesses one or more serious defects. Hence it is that we look forward to each new antiseptic with the hope that it may possess all the advantages of the old drugs, and none of their disadvantages. The claim has been made that creolin is an improvement over carbolic acid, corrosive sublimate, or iodoform, which constitute our most important antiseptic drugs. In order to judge, if possible, of the value of this claim, I have undertaken to study the literature of the subject, and examine evidence for and against this new preparation.

One and one-half creolin, according to the analysis of Professor H. B. Hill, of the Howard Medical School, is a mixture of the sodium salts of some resinous acids with the part of oil of tar known as "irod oil." He thinks the sodium salts are probably what is known as "Harzeife," a resin soap. The oil contains a small amount of carbolic or cresylic acid according to Dr. Hill. Other observers report the absence of any trace of carbolic acid. Pearson & Co., of Hamburg, who offer it in the market, give the following analysis:

	Per cent.
Neutral hydrocarbonates	66.
Phenols (without carbolic acid)	27.4
Organic bases	2.2
Ash	4.4
	100.00

Creolin is made from English pit-coal by distillation, and is of brownish-black color, and syrupy consistency. It is not a definite chemical compound, but a mixture of various ingredients. It is insoluble in water, but quickly forms with it a brownish or milky emulsion. It also mixes with oil and glycerine. In absolute and

ninety-five-per-cent. alcohol it is soluble in all proportions; also in chloroform and ether. It is non-volatile.

Creolin was mainly used in veterinary medicine previous to the year 1887. In that year its properties were investigated by Esmarch and Eisenberg, and by them the drug was brought to the notice of general practitioners.

According to Dr. Jessner,[1] the bacteriological works of Esmarch and Eisenberg show that a three-per-cent. solution of creolin equals a five-per-cent. solution of carbolic acid in antiseptic value.

The same observers[2] claim that a one-per-cent. solution of creolin retards the development of bacteria better than an equal strength of carbolic acid, and that a five-per-cent. solution of creolin destroys pathogenic bacteria.

Dr. Spaeth[3] and others took daily doses of eight grammes o creolin for some time without experiencing any bad result. There was noticed decrease in intestinal gas, inodorous fæces, urine which remained a long time without undergoing ammoniacal fermentation. A patient of Dr. Korturn, by mistake took sixty grammes of creolin in five-per-cent. solution without bad result.

Esmarch experimented with decomposing material, the germs of Asiatic cholera, typhoid fever, anthrax. Creolin proved a more powerful germicide than carbolic acid, except in the case of the bacilli and spores of anthrax.

At the beginning of the present year, the German opinions upon creolin are summed up in *Braithwaite's Retrospect*[4] as follows:

Dr. P. Baumgarten states that he has found it to be a strong animal poison and also an antiseptic, yet only in solutions of a strength that would be fatal to animal life.

Dr. Behring comes to the conclusion that creolin possesses antiseptic properties three or four times as weak as those of carbolic acid in solutions of equal strength. A two-per-cent. solution of creolin will not disinfect wounds. The drug is not so poisonous as carbolic acid.

Dr. Eisenberg states that he has found two-per-cent. to five-per-cent. solutions of creolin to be powerfully antiseptic, killing almost immediately streptococci, staphylococci, cholera bacilli, and other bacteria. Seidel and Hornicke agree with Eisenberg.

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[1] *Therapeutic Gazette*, 1889, p. 830.
[2] Ibid.
[3] *Medical News*, December 1, 1888.
[4] January, 1890, p. 243.

Hunermann, as the result of a long series of investigations, states that creolin has no right among antiseptics. It undoubtedly retards and in some cases even prevents the further growth of bacteria, but does not kill them. Dr. Korturn and Dr. Bunsen have tried the drug in obstetrical practice, and say that they have found it a most admirable antiseptic, not being so irritating as carbolic acid, and possessing styptic properties. For washing the vagina, Bunsen uses a one-half-per-cent. solution. Dr. Rausche highly lauds the deodorizing properties of creolin, and uses it as an application for burns, superficial wounds, etc.; he also advocates its use in form of soap for cleansing and deodorizing the hands. Drs. Amon and Prutscher have used a weak solution of creolin in optic and aural surgery to great advantage. From the references quoted it would seem pretty well established, in spite of some contradictory evidence, that creolin possesses decided germicidal power, and that in quantities liable to be used it is non-toxic.[1] It has also proved to be a reliable hæmostatic and a powerful deodorant. It does not injure the hands or instruments. Having such qualities, it has come to be used advantageously in the ordinary routine of antiseptic surgery for disinfecting instruments and hands and for irrigating wounds; also in the treatment of inflammation of the ear and eye, in catarrhal conditions of the nose and pharynx, in cystitis, gonorrhœa, vaginitis, endometritis, and in the antiseptic treatment of labor. It is also efficacious in removing the odor of cancer and in the treatment of burns. Granting that creolin is an efficient germicide, it possesses advantages over carbolic acid. It does not roughen the hands, as does carbolic. The full strength of the drug can be put on the skin with impunity. It is practically non-poisonous, while carbolic is a violent poison, needing to be carefully guarded. It is more agreable to mucous surfaces than is carbolic, tending to prevent excessive secretion and to reduce congestion. When compared with corrosive sublimate, it can be said to have the same advantages over it that it possesses over carbolic,—namely, in being non-toxic, non-irritating, non-depressing as regards mucous surfaces.

Dr. E. O. Otis[1] makes the statement that creolin combines the favorable workings of iodoform and corrosive sublimate.

The drug has, however, certain disadvantages, not the least of which is the fact that it is a secret preparation. Pearson & Co., of Hamburg, are the most reliable manufacturers, and they guarantee

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[1] *Boston Medical and Surgical Journal*, August 9, 1888.

to keep the article up to standard strength and quality. And it has been proved by laboratory experiments that the virtue of the drug has been quite constantly maintained. The negative experiments, however, of certain observers might be explained by supposing some specimens of creolin to be less powerful than others. The opacity of creolin is a disadvantage, since it obscures instruments immersed in it, and hides surfaces under treatment. When an emulsion is allowed to stand, a gummy, resinous mass is precipitated, and this may adhere to instruments left in the fluid, making them sticky and difficult to clean. The faults of creolin are, however, not serious, and it is not surprising that the drug has entered into our dental materia medica. It is useful in several ways. First, as a mouth-wash. For this purpose one or two drops of creolin are added to half a tumblerful of water. The emulsion thus made is practically inexpensive. Four or five ounces of the drug, which is quite cheap, will furnish a mouth-wash three times a day for a year. Being a powerful deodorant, it corrects disagreeable odors connected with many well-known conditions of the teeth and mouth. Being a reliable germicide, it will at least hold in check the growth of acid-producing germs. Being non-poisonous, it can be prescribed freely and placed in the hands of patients without fear of untoward results. Its slightly astringent action upon mucous surfaces gives it a peculiar range of usefulness in soft and congested mouths. Its slightly alkaline reaction fits it to correct acid conditions, and, finally, and of no small consequence, its taste of a tarry nature is agreeable to most people. A second sphere of usefulness is in the treatment of fistulous tracts or any suppurating surface. In such cases it tends to diminish secretion and induce a healthy state of the tissues. It is also a good drug for root-canals. It will quickly deodorize a dead pulp, and it makes a reliable antiseptic for the subsequent treatment. If desirable, it can be mixed with alcohol in any proportion, and thus an antiseptic and drying action can be at once secured. In short, it can be used wherever we would use carbolic acid, except in cases where we wish to produce a cauterizing effect or relieve pain.

A minor use to which creolin may be put is that of taking rust off of instruments. To accomplish this the full strength should be used, and the instrument rubbed with a rough cloth or a piece of Faber's rubber and corundum ink eraser. A convenient way of using it is to apply to a felt laboratory wheel.

As to the strength of creolin solutions, a two-per-cent. is commonly used for instruments and hands, and a one-half to

one-per-cent. for irrigation of wounds and treatment of mucous surfaces.

If any wish to read up on creolin, I would refer them to a very complete and carefully-written article by Dr. E. O. Otis, of Boston, printed in the *Boston Medical aud Surgical Journal*, June 20, 1889.

In conclusion, let me say that though creolin promises to be a valuable drug, yet it is still quite new, and we must experiment carefully with it till its true place of usefulness is established. Meanwhile, we should not entirely abandon carbolic acid, corrosive sublimate, or any of the old drugs which have proved themselves efficient in our hands.

DISCUSSION.

Dr. Williams.—I think the paper by Dr. Potter is an excellent one, showing thorough research and giving a full exposition in brief of the qualities of the drug. I had a little experience with creolin a year or so ago, and in my use of it I found that it had antiseptic qualities to a large extent, but the odor is objectionable. It is called a deodorizer, but I should think that superodorizer would come nearer to the truth. I ceased to use it on account of its strong tarry odor, which is disagreeable to patients, to some more disagreeable than creosote. I had before that used Little's soluble phenyle, a somewhat similar thing, but the sale of this was discontinued on account of its being an infringement. I have also used the "royal disinfectant," which they say at Metcalf's is the same thing as soluble phenyle. It makes a milky solution in water, and has a less tarry odor than creolin. To me creolin is not unpleasant; its odor indicates a positive purifying, corrective quality, which gives the impression that it will do some good, but to the nasal sense of most people it is rather disagreeable. It has one advantage that the essential oils of course have not,—it can be used in aqueous solution, but the essential oils are more durable; the effects last longer and are not so easily dissipated. The coal-tar preparations do not so readily penetrate the tubuli. If we wish to saturate a dead root, for instance, unless we put a little alcohol with them, they will not be well absorbed. I have generally preferred for such use the essential oils, or a slight amount of alcohol sometimes modified with glycerin. There is also a comparatively new preparation which is called liquid cosmoline, which they tell me at Metcalf's corresponds to glycerin,—that is, its relation to the coal element is the same as that of glycerin to animal fat. It is

practically liquid vaseline. A little alcohol will thin it to such an extent that it will be absorbed. Of course, as Dr. Potter says, in cases of fistula or abscess something of the nature of creolin or phenyle is often preferable to the essential oils.

Dr. Eames.—I can only add a word in thanks to the author of the paper. There seems to me not much further to be said in regard to this particular agent. My experience, and that of my friends, is that phenyle is now, to quite an extent, used as a substitute for creolin. The use of creolin has, however, been very satisfactory, especially in its kindly action on mucous membranes. I had hoped that some one might bring up pyoktanin, the antiseptic and disinfectant spoken of so highly by medical men.

Dr. Williams.—That reminds me that there is an objection to pyoktanin. Although it has apparently very sound claims as a positive antiseptic, it has one disadvantage for us, which is that it gives a blue color,—produces a blue stain. There is a pyoktanin which gives a yellow color, and which perhaps might not be quite as objectionable, but neither of them could be employed for use in the teeth with any degree of satisfaction.

In my use of creolin, or the phenyle solution, both similar preparations, the creolin being the stronger, I have sometimes found a weak watery solution very useful in saturating a cement which was to be put into a deep cavity where a little softened dentine remained in the bottom covering the pulp. I would treat the cavity first with such strictly antiseptic solutions as I thought the tooth would bear, and then cover its deep parts with Wilson's non-irritant (said to be a magnesium cement) or plaster of Paris wet up with a weak watery solution of creolin or phenyle, these drugs maintaining an antiseptic influence in the cavity. Over this layer an oxyphosphate cement, or whatever is best, may be placed. I prefer something of that softer nature in the very depth of the cavity, as the pulp is less apt to be rebellious, and the filling can be graduated with harder materials as you get farther away from the pulp.

Dr. Andrews.—Speaking of mixing antiseptics with the different powders for the purpose of covering a pulp which was nearly exposed, calls to my mind a paper which was prepared by Dr. Charles Atkinson, of New York, to be read at Berlin. Unfortunately, it was voted there that no paper could be read whose author was absent, so that among other excellent papers it was thrown aside. Dr. Atkinson sent to me, with the paper, some thirty specimens of oxyphosphate fillings, mixed with different antiseptics. They were all in hard cakes, and most of them seemed quite as hard as they usu-

ally are when mixed with nothing but the fluid, while the odor of the different antiseptics used was very perceptible. His paper spoke of the importance of using these medicated cements over exposed pulps, and said that a good deal of the antiseptic material can be mixed up with the powder and yet make a good hard filling.

President Seabury.—How are the antiseptics mixed?

Dr. Andrews.—I do not know his method. I suppose the antiseptic, such as oil of cassia, or carbolic acid, is mixed with the powder first.

Dr. Smith.—In a recent issue of the *Boston Medical and Surgical Journal* some writer cautions the medical fraternity against the use of creolin on the ground that it was liable to cause a humor. I presume Dr. Potter may have seen that. It was in the September number, I think, of the *Medical and Surgical Journal.* Speaking of antiseptics as a whole, after reading Dr. Miller's late paper on this subject, one has to come to the conclusion that the supposed new antiseptics are of but little value as antiseptics, and we have to fall back on such agents as carbolic acid and bichloride of mercury. According to his experiments, iodoform, which the medical fraternity have hitherto relied on, amounts to but little as a positive antiseptic. Perhaps when creolin receives his attention it will be classed in the same list.

Dr. Williams.—I think Dr. Miller speaks more particularly of the active agents, which are called germicides or bacteriacides, instead of those that have simply an aseptic influence,—he speaks more of those that will actually kill the bacteria. I think it is now claimed that iodoform is not so active, but very good to keep up the resistance, as in preserving the tissue, or helping it to resist the advance of germ-life.

Dr. Andrews.—Dr. Black, as a result of his experiments, stated, if I remember rightly, that germs not only lived in iodoform, but they increased in it.

Dr. Eames.—There is so much ambiguity concerning the meaning of the words "antiseptic" and "disinfectant" that I would like to know the opinions of the members with regard to it. One authority says that an antiseptic prevents the formation of germs and a disinfectant kills them. Authorities conflict in their definition of these terms. I am led to conclude that both are antizymotics, having the power to arrest fermentative processes. Antiseptics prevent or retard septic decomposition, disinfectants destroy the specific germs of disease, many of which are due to the action of microbes. Therefore many antiseptics are also disinfectants.

Dr. Potter.—The terms disinfectant, antiseptic, and germicide are often used as synonymes. According to Edes's "Therapeutics and Materia Medica," p. 245, however, the following distinctions should be made: Antiseptics are such substances as prevent putrefaction or septic decomposition, while disinfectants are such substances as render organic matter not only incapable of putrefaction itself, but of becoming the starting-point either of putrefaction or any of the morbid processes dependent on peculiar organized ferments when brought in contact with other organic matter. Germicide is a term which in the present status of the germ-theory is nearly or quite equivalent to disinfectant.

The American Academy of Dental Science held its regular monthly meeting, January 7, 1891, in the Boston Medical Library Association rooms, President Seabury in the chair.

The paper for the evening was read by Jacob L. Williams, M.D. Subject: "Plastic Materials in the Preparatory Treatment of Teeth."

PLASTIC MATERIALS IN THE PREPARATORY TREATMENT OF TEETH.

BY JACOB L. WILLIAMS, M.D.

In the whole scope of the practice of oristry perhaps there is no subject that more constantly presents itself than the need of avoidance of pain, together with the preservation of vitality in the organs to which the larger part of our attention is given.

Preparatory treatment of living teeth, of which only I shall speak, may be advisable in two classes of cases,—one where the pulp is endangered but not exposed, for the purpose of pulp protection, by arrest of caries and favoring deposit of secondary dentine; and in another class, where the dentine is too sensitive to permit without discomfort the proper preparation of cavities for permanent filling.

I will briefly mention how I first came to devise a plan for the treatment of the former class of cases, and which resulted in an adaptation for the treatment of the second class.

About the year 1850, and during my early practice with Dr. Keep, many useful teeth that were too frail to bear hard metallic fillings, instead of being doomed to extraction, were filled in various extemporized ways, to render them comfortable while they might last.

A material called Hill's stopping, coming forward about that time, was somewhat used, but, being a mixture of sulphate of lime with gutta-percha, it would become rough or fuzzy in the mouth; also being patented was considered an obstacle to its free use. So oxide of tin with a little fine spar was mixed with gutta-percha, which made quite a solid and comparatively durable stopping. But it had a serious objection in that it became discolored and often discolored the tooth substance.

Thinking over the matter frequently, it occurred to me one day

that oxide of zinc might be free from these objections, and on trial I found it to be the fact.[1]

As it was common then to take pride in exclusive knowledge, I kept the secret to myself for some time, only loaning it to two students, one of whom gave it the name of "dentron." They derived some income by making and selling it to Codman & Shurtleff, who found a ready sale for it. When those students came to have no further occasion for that resource, I told the before-named firm of its composition, and they then began to make it for themselves. And being then freely spoken of, knowledge of the composition gradually became more general, and other dealers made it.

To resume. While using the tin combination I noticed, on removing the old stoppings for renewal, that the dentine had become *hardened* as well as discolored, and pulps that were before almost exposed were found protected by a firm covering of secondary dentine; and the thought came to me, Why could not a plan of treatment be adopted for the purpose of favoring this corrective and conservative action?

I reasoned that the morbid conditions in the cavity must first be corrected, and then held in suppression to allow nature to carry out her protective efforts. Those morbific elements seemed to be fermentive and acid action. We knew nothing of microbes then, and what was the acid I knew not, but Dr. Miller has since informed us that it is mainly lactic.

To correct the fermentative process I saturated the cavity, after slight excavations, with a solution of chloride calcis, and to neutralize directly the acid. I used simple aqua calcis, each of which produced the desired effect.

But then the point was, how to place and hold the mischievous agents in subjection without irritating or destroying the subjacent vital tissues on which depended the renewed protection.

To accomplish this there then seemed to be nothing better at hand than creosote; but that used pure would be too caustic, so I diluted it *largely*, and saturated the cavity with the weak solution, and sealed it up; but how? I reasoned that the interior of a tooth, even in health, being softer and more elastic than other parts of it, something of a similar lack of density, as well as non-conductivity, should occupy the depth of the cavity.

Even the gutta-percha stopping would be too solid for some

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[1] I cannot find any evidence that this combination had ever been made before.

cases; and for them I mixed beeswax with it for the deeper layer, covering it with the firmer material. I also found that a bedding of oxide of zinc or of sulphate of lime mixed with the mild antiseptic answered the purpose admirably.

These corrective applications were repeated at intervals varying with the apparent needs of the cases.[1]

I made a brief mention of this plan in the *American Journal of Dental Science* in 1858.

In the course of time other antiseptics have been added to our armamentarium, giving greater vriety of facilities in this line.

The principle of this plan of treatment that I have described is to destroy the morbific agents in the cavity, and keep it aseptic without destroying the living tissues, or so irritating them as to endanger destructive inflammation. And during all the years of practice on this principle, patiently followed, I have found its results successful, even beyond my early expectation. It sometimes seems to require almost an unreasonable amount of patience, but we must learn to wait on nature, or she will not help us.

In regard to corrective applications, how often are caustics or irritants used, perhaps with the idea that the strength of the corrective will insure the duration of its effect, without considering that it may, as it often does, destroy the desired vital protective action!

And in relation to the relative density of interior dentine to the rest of the tooth, how often do we find an endangered pulp struggling in its minute pulsations against an unyielding phosphate stopping that lies almost or quite in contact with it!

And still further, how often have we seen a hard filling of malleted gold or of analgam, in a deep cavity, supposed to be safe, but by its relentless presence provoking rebellious inflammation and death of the pulp!

In following up the treatment for endangered pulps, it was readily observed that the marginal dentine also was obtunded, and often only by the presence of the plastic stopping, though the calcic saturation seemed to be a positive aid.

And this manner of obtunding extremely sensitive dentine in preparation for permanent filling I cannot but think preferable to the way of merely putting the fibrils to sleep, from which to wake and find themselves imposed upon by a rigid and temperature-conducting foreign substance, provoking them to neuralgic protests.

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[1] This new plan of treatment of course met with many amusing attempts at criticism.

DISCUSSION.

Dr. Chandler.—I would like to ask the essayist what is the advantage of oxide of zinc, finely pulverized, over feldspar? Why not mix that in place of the oxide of zinc?

Dr. Williams.—I found that the oxides, especially the oxide of tin, made a more intimate combination with gutta-percha than any of the simple pulverized minerals like spar. We did at first mix a little spar, thinking to make a stiffer mass, and thereby counteract the stringiness of the gutta-percha. I found, however, that the spar made the filling more friable. It was very much like trying to make putty with chalk. It can be done in a way, but an oxide will make a harder material than any simple substance like white feldspar, or even clay. Oxide of tin was found to be too dark in color, and often discolored the teeth, though I think it had a more antiseptic effect than oxide of zinc. I took precautions, however, to insure the aseptic condition of cavities without regard to the material used for stopping. Oxide of zinc combined nicely with gutta-percha, at the same time making a white filling and one which would not discolor the teeth.

Dr. Andrews.—I think it is twelve years ago that I read a paper before the Massachusetts Dental Society on preparatory filling. I have the paper at home, and wish I had brought it with me that I might speak of some of the points contained in it. My idea was to prepare young teeth for future permanent fillings by using adhesive plastic stoppings. And I stated that I found some advantage in using lacto-phosphate of lime under such fillings in order to induce the pulp to throw off calcifying material, and thus make the teeth more dense. I was pretty heavily sat down upon by Dr. Chandler and other members present. Dr. Chandler did not then believe that there was an advantage in preparing frail young teeth so as to bear permanent fillings.

I believe that under adhesive fillings the tubuli are partially recalcified.

Dr. Black and others will tell us that the tubuli are filled with fat. I believe that the material which they call fat consists of minute globules, to which have been given the name of calcoglobulin, and these become calcified. I believe most heartily in preparatory fillings.

Dr. Chandler.—I remember the circumstance to which Dr. Andrews alludes. I did not then believe that lacto-phosphate of lime had any special virtue, and I do not believe it now. As I

remember it, he made the statement that the lacto-phosphate of lime had some chemical or physiological action on the inside of the tooth which modified its condition and improved its quality. The ground that I took was that the simple filling of the tooth with gutta-percha stopped the fluids outside, arrested the ruin that was going on, and left the inside to take care of itself. It prevented all outside irritation and permitted the odontoblasts to go on with their natural work of depositing secondary dentine, but the filling had no chemical action, or any other influence with the tooth except the exclusion of destructive oral fluids.

Dr. Andrews.—I wish to correct the gentleman on one point. It was not gutta-percha which was used at that time, but oxychloride of zinc. The same results might, however, be obtained under gutta-percha if the same treatment were employed, provided the filling be absolutely tight. I will cite an instance showing the value of this preparatory filling. A student of mine had a pulp which was clearly bare, showing the pulsations of the vessels. An article which I had somewhere read stated that if lacto-phosphate of lime were placed over a pulp it would cause that organ to throw off calcifying material, thus forming a new covering. I had never as yet tried this method, but I now used it upon my student. The application was made, and an oxychloride filling inserted and kept there for about two years. At the end of that time, the filling, being worn down, was taken out, and a complete covering of dentine was found over the pulp. A gold filling was then inserted by Dr. I. J. Wetherbee, using the hand-mallet. The filling was made at a clinic before the Massachusetts Dental Society about ten years ago. I believe the filling is still in position, and the pulp still alive.

Dr. Tucker.—Some ten or twelve years ago I was filling a cuspid tooth for one of my own family. It was a large cavity and the pulp was nearly bare, so that you could distinctly see the pulsation. I filled it with gutta-percha, Hill's stopping, and allowed it to remain there for twelve months. Of course I had a chance to see it whenever I pleased, and I know that there was never any trouble or inflammation about it. At the end of the twelve months I removed the filling, and at the bottom of the cavity there was a hard polished substance which was protecting the pulp. I then filled the tooth with gold, and it has remained perfectly well and healthy these twelve years.

President Seabury.—Did the pulp bleed any?

Dr. Tucker.—Not at all. It was apparently in good condition, but you could plainly see the pulsation before using the gutta-percha.

Dr. Williams.—Some years ago, when lactophosphate of lime was suggested as a nutritive help to pulps in forming secondary dentine, I tried it for a while in several cases. The impression which I got—I will not say that I established it as a scientific fact—was that it favored the formation of nodules in the pulp rather than the formation of an even layer over the most exposed point. Several cases of exposed pulps which I treated with lactophosphate of lime I afterwards found had pulp-stones in them, and for this reason I left off using it.

Dr. Briggs.—A great deal of credit is due to Dr. Williams for his efforts to establish the efficacy of preparatory fillings in the treatment of teeth. Dr. Andrews speaks of the criticism to which the method was subjected twelve years ago. I was in the way of hearing those criticisms, and I am now very much pleased to congratulate Dr. Williams on having lived to see his theory placed on a footing where it cannot be criticised, and to see the profession cordially endorsing it.

President Seabury.—As the next thing on the programme, Dr. Andrews will show his improved saliva-ejector.

Dr. Andrews.—I suppose that most of us have had the same trouble with the ordinary saliva-ejector that I have had. I refer to the disagreeable sucking noise and to the pain that is caused to the patient by having the mucous membrane sucked into the slits or openings in the mouth-piece, sometimes causing a painful bruise. I have devised an appliance which has relieved me of all this trouble. It is very simple, and I cheerfully give it to the members of the profession. A small tube, open at the upper end, is soldered to the main tube, and opens into the bulb at the end of the mouth-piece a little lower than the openings in which the saliva is taken into the pipe. It is impossible for the mucous membrane to be sucked into these, as the air coming down this small tube would immediately release it. The one that I show you is rather a clumsy one, but works very perfectly in the mouth. Any brass-worker can make them.

President Seabury.—Cannot you alleviate that trouble by shutting off the water and making the suction less?

Dr. Andrews.—No; I have tried running the water slowly, but if there is suction enough to take the water in at all, it will also suck in the mucous membrane.

President Seabury.—I have an ejector designed by old Dr. Fisk when he first invented the saliva-ejector. By slowing the water the sucking noise will stop, and yet there is force enough to remove the saliva.

Dr. Williams.—I want to mention a shape designed by Dr. Merrill, an associate of mine. It is rounded like a ball, but turning in with a slight cup around the tube which comes up in the centre. The holes, instead of being in the side of the tube, are in the top of the cup, and the tissues are not liable to be drawn into them. I like its working very much.

Dr. Eames.—At the last meeting I read a paper on "Sensitive Dentine," advocating the use of warm air as an obtundent. The appliance I then had for warming the air being open to many objections, I have since experimented with small metal tubing, and as a result this little contrivance is now presented for your inspection. I have been using it successfully, both with the compressed air-tank of Codman & Shurtleff and with the common foot-bellows.

The tubing is coiled closely in this shape, and is connected with the foot-bellows or air-tank, and placed on the rim of the bracket-lamp. To the delivery-end is connected a nozzle of glass, containing a thermometer which indicates the temperature of the air very near the point of exit. This is essential, as the air cools very rapidly in travelling a short distance.

My main point was the advocacy of warm air at a certain definite temperature, and by means of this instrument one can judge very nearly what the temperature of the air is when it strikes the tooth.

There is no need of freezing a tooth or boiling it, when 115° F. effectually obtunds the sensitiveness of dentine. During the past three or four weeks I have been using warm air exclusive of other means or medication, and it has been successful in every case thus far.

At the present time I allow the temperature, as indicated by the thermometer in the glass tube, to range from 115° to 125° F., using my best judgment as to the temperature of the tooth-structure itself. This is modified, of course, by the nearness with which the point is held to the tooth. I aim to have the temperature such that I can hold the nozzle in contact with the tooth.

Dr. Fillebrown.—There is already in use a gas-burner which automatically controls the flame and regulates it to any desired temperature. This might be used under a small tank of water in which a coil of pipe is immersed. The air passing through the coil would be heated to any desired temperature.

Dr. Eames.—The air will cool before it reaches the mouth.

Dr. Fillebrown.—You can have the coil as near the mouth as you wish, and if necessary allow for the cooling of the air.

The American Academy of Dental Science held its regular monthly meeting at the Boston Medical Library Association Rooms on February 4, 1891.

President Seabury in the chair.

The paper of the evening was by E. G. Tucker, M.D.; subject, "The Organization and Diseases of the Teeth."

THE ORGANIZATION AND DISEASES OF THE TEETH.

BY E. G. TUCKER, M.D.

Mr. President and Fellows of the Academy,—As an *important branch*, I have selected that which relates to the organization of the teeth and a few remarks on the technical phrases of the teeth and diseases.

In attempting to explain the organization of the teeth, I shall not fatigue you with long and tedious recitals, or attempt a refutation of those propositions which neither result in a clear conviction of truth or useful knowledge, by doubting the very existence of my person and of others around me, until logically proved to exist.

That no reasoning of mine or of the ancients will be necessary to convince you, without the aid

> "Of ancient critics
> Although profoundly skilled in analytics,"

I find it difficult to summarize the many opinions advanced. Those who are acquainted with the writings of Fauchard, Monroe, Audibran, Robert Blake, Duval, Fox, Fitch, and Thomas Bell, or know the opinions of intelligent practitioners, doubtless think the question so well settled as to render further argument unnecessary.

The famous Mr. Lawrence, of London, published in the *Medical Gazette* of June, 1830, his opinions, and attributes all diseases of the teeth to a "chemical action." To say nothing of the absurdity of calling diseases a chemical action, I would ask, How then can these affections be inherited or constitutional? That many are so is not only a popular belief, but a truth to be learned by a very little observation. We see children as often resembling their parents in *dental* as in pulmonary or in any other peculiarity, complexion, etc.

The expression "the teeth of all our family go just so" is not only an assertion which a dentist has almost daily to hear, but one which *facts* compel him to give his assent.

Numberless facts on this point might be collected, but proof is not needed. Every candid observer can convince himself of the truth in one week, if such proof be necessary.

In many cases the application of cold or hot substances, and more especially of sweets or acids to parts denuded, occasions sensations so disagreeable as to render it difficult to convince the patient that the nerve or pulp is not exposed.

Teeth possess this irritability at times and at all periods of life; differing, of course, in degree like all other irritability or fretfulness in different individuals. The enamel is devoid of sensibility, but there is no other part of these organs which does not possess it, as bones do. Now what is it that is thus transmitted from one generation to another? Is it a liability to a chemical action, or are the teeth, like the lungs and other parts, rendered liable to or exempt from disease?

The late Dr. Harwood, of Boston, had a variety of specimens of diseased roots, and no one who examines them would hesitate to ascribe the peculiar appearance they present to genuine exostosis, not only the surface, but the substance of the superadded parts is of a very hard and dense texture, of a yellowish hue, and before being dried was semi-transparent. The roughness presents a striking contrast to healthy roots. Where does this matter come from, and how comes it to be so firmly united with and forming, as it were, a part of the root?

If it were a mere deposit, it would be easily separated from the original bone. It seems to me that the occurrence of this disease proves the existence of vessels in whatever part it may happen, and we might believe that the phenomena presents a morbid growth of the parts.

Chemistry has done wonders, but I am hardly prepared to believe that exostosis is one of its products.

I have seen teeth that have been buried more than one hundred and fifty years, but they presented none of the appearances just described. Nothing in fact does resemble a tooth thus affected but necrosed bone, and if not removed by art, nature accomplishes the thing herself.

These unorganized *pegs* not only manage to imitate diseases but counterfeit resemblance to them remarkably well. When by accident or design a portion of the enamel is removed, the exposed bone becomes irritable, but with proper treatment the tenderness in most cases disappears. Where this has happened, and the bone continues healthy, it is found, on close examination, that it has become

much harder than ordinary bone or dentine, and that the surface has assumed a peculiar bright, glossy appearance; such facts have, no doubt, given rise to the erroneous idea that a new enamel is sometimes formed. Now, here is not only a modification of sensibility, but a change of structure which must depend upon vitality and organization as much as dental gangrene.

The diseases of the teeth have not received that attention desired heretofore, except when felt; then came the cold iron, an evil nearly equal to the prior one. The work of destruction is now and then interrupted by some internal power, and the organ remains for years.

I cannot pass this point without making a short digression, for which I hope to be pardoned. The vulgar phrase "rotten teeth" is not merely an indecent one, but it conveys to the uninformed mind an utter falsehood, and, I fear, is not always used with a proper understanding by those who should know that the teeth are incapable of such a process as rotting, any more than the flesh of a healthy man. That process which is termed "rotting" of teeth, or, sometimes, for decency, "decaying," ends totally at death, and never is or can be continued in the grave.

Extract a tooth and you immediately stop its so-called "rotting," nor can you by any means make it go on except under artificially produced conditions similar to those that caused the decay in the mouth.

In most cases, if people knew the nature of the evil, they would attend more to the prevention, if not to the cure.

Cleanliness would at least be attended to, and I honestly believe that half the teeth that are lost might be saved.

People may have foul mouths full of corrupt substances, and thus inflammation and decay may be produced in their teeth; but let them be told and made to understand that their teeth can take on no such process until after they are softened and prepared by disease, which is in most cases easily prevented or cured.

Physicians, of all men, should be careful how they use this ill-chosen phrase. It has a technical and generally understood signification; its legitimate application is to *dead* matter. If, therefore, you tell a man that his teeth are rotting, you virtually tell him that they are in a hopeless condition, and he acts accordingly in nine cases out of ten.

The late Dr. Flagg succeeded in coloring the whole tooth by mixing madder in the animal's food, and also Dr. Fitch, of Philadelphia, states that he had several specimens of extracted teeth of a

plethoric woman, aged twenty-seven years, who died of a violent inflammatory fever, and the teeth were completely injected with red blood.

We see the roots covered with periosteum like other bones, and a large number of vessels enter this membrane of such magnitude as to bleed profusely when torn asunder.

Is it philosophical to suppose that *arteries* and *veins* are sent thither for the mere purpose of coming back again? or that the nerves that accompany them have no other end to answer than that of subjecting us to the vexation and madness of toothache?

We know that teeth can be transplanted from one jaw to another; which, though injudicious, has in some instances been successful.

There are few organs which are more important in the influence which they exert upon the general health than the teeth, and there are few diseases so much neglected and which receive so little attention from the hands of the medical practitioners. Lately, however, they seem to have greatly changed, and their reluctance heretofore manifested is giving place to more rational views, and we find now many of them ardently devoting themselves to what was once considered beneath the dignity of their calling.

A grave impression, somewhat prevalent, is this: that the diseases of the teeth are a natural consequence, a process of nature which none are exempt from, and that it is not within the power of the dentist to check its ravages.

An interrogatory very often sounds in our ears, namely, "Why, if filling the teeth is so essential, how is it that we find so many failures?" The solution of the query is, that such persons or services as would insure success have not been employed for the sake of economy, instead of which an empiric has been called upon to do the work.

There are many persons in the world who are too "*penny-wise*" to make use of any other wisdom, judging the dental science to be a mere mechanical one, and, to use the words of another, "this is the rock on which they split."

However natural it may be for us all to indulge in a partiality for those subjects which have engaged much of our time and attention, yet every one must agree that the advantages of this art, aside from its effects upon the general health, are sufficient to excite our laudable and generous efforts in diffusing its principles in the community. The vast importance of preserving the organs of mastication and articulation is apparent to every one, as an indispensable requisite to sound bodily health, for there are many affec-

tions which arise solely from the diseases of the teeth, such as dyspepsia, tic douloureux, etc. Still, there are no operations in surgery which, when performed as they should be, are more certainly successful in their results.

DISCUSSION.

Dr. Fillebrown.—I was sitting so directly behind the speaker that I did not hear the first of the paper with sufficient clearness to be able to discuss it. I wish, however, to express my general agreement with the paper, and my pleasure in listening to the dissertation of a person of Dr. Tucker's age and experience. I wish to thank him for giving us the benefit of his thoughts to-night.

President Seabury.—There is one point in the paper that struck me very forcibly. We used to call decay of the teeth a vito-chemical action. Dr. Tucker has set forth very clearly that chemical action ceases when the vital action ceases; that is, that a dead tooth never decays when out of the mouth. It had not occurred to me before in that light. It is necessary to have life in order to have decay.

Dr. Meriam.—The rotting which the doctor speaks of is an important matter, and seems to be confined entirely to substances which go on rotting when separated from their vital connections. For instance, we find that an apple rots after its removal from the bough. The experience of the past few years has developed very clearly the medical relation of the operation of filling teeth. The change in the medical practice of to-day means an added importance to dentistry. There was a time when in nearly all diseases a low diet was prescribed. To-day, even in fevers, a patient is fed and given all the nutrition he can possibly care for. This is to prevent, as far as possible, a person coming out of a sickness in a debilitated condition. A short time ago a very learned physician said to me, referring to our specialty, "A man who fixes another so that he can eat does a great service." Medically speaking, that describes the physiological office of the dentist. "He fixes a man so that he can eat." I did not come prepared to speak, but I felt it was my place to come when Dr. Tucker was to read a paper. When he does us that honor, there is an opportunity to show the pride which some of the younger men have in him.

Dr. Mead.—I was saying to Dr. Tucker before the commencement of the meeting that nothing would have drawn me forty miles to-day only to hear his paper. I have known Dr. Tucker since my boyhood, as a man and as a scientific operator, and it affords me great pleasure always to meet him on these occasions, but more particularly now when, at his advanced years and with his great ex-

perience, he is equipped with those attributes which inspire every man to do good work. I am very happy to have been here this evening, and should not have come if it had not been for the pleasure of hearing him.

President Seabury.—The next thing in order will be "Incidents of Office Practice and Presentation of Specimens." I will mention a fact that was brought to my notice to-day,—that is, it is supposed to be a fact,—that aluminum foil is practical as a filling-material. It is said that it can be beaten out as thin as gold and that it is soft and pliable and will pack into a tooth as well as gold. It interested me very much and I took measures to find out more about it.

Dr. Williams.—I hope the president will ascertain where it can be found.

President Seabury.—I shall. It is a remarkable metal; it is not corroded by the oxygen of the atmosphere any more than gold is, and has other valuable qualities which make it available for our use.

Dr. Fillebrown.—The first aluminum manufactured for dental purposes was said to fail in the mouth on account of its not being pure. It is now being made quite pure.

Dr. Meriam.—I think there would be no difficulty in having any gold-beater make a foil, if a sufficient number of dentists would take it. The purer metals are, the easier they are worked. Dr. Carroll, a maker, who was on here with a furnace, produces aluminum foil, and I think I have a sample of it now which he passed around in New York. It is a soft foil to be used in cylinders. I have not attempted to use it, but think there is no cohesion, and should question whether it would be as practicable as gold.

Dr. Williams.—Some time ago I tried to mix aluminum with mercury, but they would not combine. Perhaps it was due to the impurity of the first preparations of aluminum, though I doubt it. I have not tried the experiment of late.

Dr. Eddy.—I wish to show a convenient method of having bill-heads. They are blocked and have stubs after the style of check-books. By having them in this shape they are always ready instead of being scattered in different drawers of your desk.

Dr. Taft.—I should like to ask Dr. Eddy how he itemizes a bill in case he is requested to do so by the patient?

Dr. Eddy.—I send them a diagram of the mouth, specifying on that the work done. The majority of them don't know a lateral from a molar, but by sending a chart they will know where the work was done. I don't suppose there are more than one or two a quarter who ask for an itemized account.

THE regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms on March 4, 1891. President Seabury in the chair.

The paper for the evening was read by Lewis S. Dixon, M.D. Subject, "Proper Care of the Eyesight."

PROPER CARE OF THE EYESIGHT.

BY LEWIS S. DIXON, M.D.

MR. PRESIDENT AND GENTLEMEN,—I have been honored by an invitation to give a few suggestions as to the proper care of the eyes and their preservation from unintentional abuse. At a time when one's attention is called in so many directions by the ardent advocates in many specialties, and the advice given is too abundant for any attempt to follow it all, it may seem superfluous to ask your thoughtful interest to this special subject.

But there are peculiar reasons why this topic should claim a little thought. First, because in your profession accurate vision and free use of it are matters of such direct importance in enabling you to apply your knowledge and obtain the good results and finish of workmanship that you desire. Secondly, because abnormal or imperfect vision adds such a decided and complicated burden to a work, of necessity, fatiguing and laborious. Thirdly, because the conditions of imperfect or faulty vision can be so positively detected and proved and so thoroughly corrected and relieved; for the advances made in certain branches of ophthalmology have carried us out of the region of probability and theory into that of almost mathematical certainty.

I am aware that, in speaking to those who have already in their studies paid more or less attention to the anatomy and physiology of the eye, I may need your kind indulgence for repeating much that is already familiar to many, but there are one or two fundamental points which it is of great importance to understand and realize, which experience shows are, as yet, but dimly recognized even by physicians, and yet they underlie and account for a large portion of the troubles commonly affecting the use of the eyes.

As a part of the body, and one of the organs of sense, many and complicated diseases may affect its various parts. Most of these are evident at once by external or easily recognizable symptoms; others, less common, affecting the deeper parts, not so evident, yet

still almost always accompanied by such impairment of vision or definite indication of trouble as to call for attention. All these fall naturally under the care of the physician, and their diagnosis and treatment are to a great extent under the same limitations and uncertainties as hold elsewhere in the body. Such difficulties are of course not included in this paper. There are, however, a very large number of people who, having very good vision, or what they suppose is good vision, and no apparent disease, have more or less complaint to make, saying that their eyes are weak, incapable of comfortable or continued use without pain or discomfort afterwards. This leads them to feel it necessary to limit the use of their eyes, for they realize that in some way their eyesight is not quite as they wish it to be; and yet, as no apparent cause is discoverable, and vision good, they rest content with weakness as a sufficient explanation. Also, there is another large class, who, with excellent sight and no symptom calling attention to the eyes, suffer much from headaches, sick headaches, neuralgia, undue fatigue, and nervous exhaustion,—who strive in vain for any real relief through medicines and treatment, and are totally unaware that the whole cause lies unsuspected in the eyes.

It is, therefore, very necessary that, in order to take proper care of the eyes, one should know the meaning of the various signs that may be noticed, and be able to recognize the symptoms of overwork or strain and understand how it comes about.

For almost every one who has fair sight, it is very difficult to realize that seeing necessarily involves any muscular effort, unless it may be when looking at objects very near. Simply to open the lids seems all that is needed. This is practically true of really normal eyes, but, unfortunately, this class is much smaller than is supposed, and many who seem warranted in boasting of their fine vision are greatly surprised to find themselves not included. The important point to remember is, that sight involves two processes, entirely distinct from one another: first, the focussing the light from the objects looked at, so as to produce an actual picture on the retina; secondly, the perception or feeling of this picture by the retina or nerve of sight. The first is entirely an optical process, controlled and limited by the laws of optics. The second is entirely a physiological process of the optic nerve and depends on its healthy action, which, fortunately, is the usual condition. The poor optic nerve has been greatly maligned, and all the impairments of vision whose causes were not evident or otherwise explained have been laid to its charge, but, unless on account of occasional disease or

exposure to excessive light, it always acts well, and practically without fatigue.

Simply as an optical instrument, however, the eye may have numerous and complicated defects, which are entirely optical and fall under fixed laws capable of demonstration and proof. And so, unexpectedly perhaps, these optical errors must be understood before the meaning of the various symptoms and complaints in regard to the eyes can be made clear. The optical function of a normal eye is exactly that of a photographer's camera,—to refract or bend the light received from objects to a focus and produce a sharply-defined picture—in the camera, on the prepared plate, so that it may be taken; in the eye, on the retina, so that it may be felt or perceived.

It is well known that the photographer has to use great care in adjusting the focus of his camera for each picture he wishes to take, the slightest variation of light or distance of the object needing corresponding changes in the adjustment. This is due to the fact that the rays of light proceed from each point like the rays from a candle-flame, diverging in all directions, and that the nearer the lens of the photographer or of the eye is to the luminous object, the larger the cone or the more divergent the rays which will pass through it, and that as the object is removed, the cone becomes smaller and smaller, till at last the rays become practically parallel.

The normal eye is so built, or formed, that its lens, immediately back of the pupil, is just strong enough—*i.e.*, has the proper bending power—to exactly focus parallel light or that from distant objects upon the retina; the lens and retina are accurately adjusted to each other for ordinary distant vision. For nearer objects, instead of the camera's screw, there is a muscular arrangement for altering the strength or curve of the soft elastic lens, so that it may have more bending power as more divergent rays get in, and so still keep the focus upon the retina. These muscles give us the power of accomodation, or adjustment, for varying distances; and for every slightest alteration in distance we have to make the corresponding but unconscious adjustment. A normal eye, therefore, is one that sees everything beyond fifteen or twenty feet without any muscular effort at all, being naturally adjusted correctly, the picture falling sharply on the retina if only the lids are raised, and the nerve having simply to feel or see the picture. And for all objects within fifteen or twenty feet, the muscular effort of accommodation is involved in rapidly increasing ratio as they approach the eye. Also, every one surely finds some point within which it is

impossible to see clearly. This point, called the "near point," represents the full and utmost power of his muscles of accommodation.

It is the abnormal and unconscious overuse and fatigue of this muscular apparatus that underlies the larger part of the weakness and trouble of which people complain. It is not that the eyes tire or are overtaxed in their function of seeing the picture, but it is that, under certain conditions, the muscles are tired and are overtaxed in producing and keeping the pictures for the nerves to see. Three conditions which may produce unnecessary overstrain and fatigue will be worth a moment's explanation. These are old sight, or presbyopia; far sight, or hypermetropia, and uneven sight, or astigmatism. The crystalline lens in youth is quite soft and easily acted upon by the muscles of accommodation, but as early as eighteen years it begins to increase in firmness or hardness, so that the same muscular effort fails to produce the same amount of change in the refractive power of the lens, and the full action of the muscles fails to bring the near point as close to the eye as it used to do. This hardening steadily increases and causes the near point to slowly recede farther and farther off. At sixteen, or so, the near point is usually about two inches from the eye, but as one seldom wishes to hold objects nearer than eight or ten inches, there is a large surplus of reserve power, and the ordinary use of the eyes, on near work, is done with ease. But, as years go by, the near point creeps outward and the eyes are obliged to call upon more and more of their reserve power to accomplish the work they used to do easily. As long as the near point lies well within the working distance, vision can be used almost indefinitely, but when the near point has receded to nine or ten inches, one needs to get almost as near as that to his work, the accommodation is taxed nearly to its utmost, and the strain and fatigue are very great, for no muscle can work at its full power long at a time.

Since the progress of presbyopia, or hardening of the lens and recession of the near point, goes on very gradually, there is no sudden change, no marked symptom to draw one's attention. It will depend greatly, therefore, on the customary length of time the eyes are kept at work at close range, upon the general health, and supply of nervous force not otherwise called upon, whether and when the eyes begin to suffer from old sight. Old sight really begins, therefore, quite early, but does not reach the condition of needing assistance until the near point has gone off to eight or nine inches; it means simply the overtaxing of the muscles of

accommodation,—not on account of the work done, but changes in the effort required to do the work; it means improper wear and tear to the nervous system, just in proportion to the demand for near work. Glasses assist this condition by bending the light partially before it reaches the eye, therefore leaving less work for the muscles to do and restoring the near point to a reasonably comfortable position.

Persistence in deferring assistance from glasses is unwise just as soon as conscious fatigue of eyes or head appears. Of course, like all other muscles, proper exercise, when not too long continued, prolongs their power and health, and in that respect it is unwise to put on glasses too early or unless there are distinct and frequent indications of fatigue. The point to remember is, that after reaching the age of forty, decided weariness, lassitude, headache, or pain in the eyes after long-continued close work is probably caused by overstrain of the accommodation, not by difficulties of general health or other reasons, and a moment's testing of the near point will often prove the cause. It follows that when close work,—*i.e.*, from ten to fourteen inches,—involves the use of nearly the full muscular power, the eyes should be frequently rested by looking off to the distance for a few moments; also, if the demands of the day involve several hours of near work, it is of course not best to continue the hard task by reading or writing in the evening, unless aided by glasses. Also, if for any other cause the system is not in good health, then the prolonged and exhausting efforts necessary for the accomplishment of the daily work not only have their injurious effect on the eyes, but use up, or rather waste, the strength needed elsewhere. Although the use of glasses can be deferred for quite a long time after they are really needed, the cost is very real and has to be paid in some way. Just as machinery may be run for some time after oil is needed, and accomplish its work well, it is with a waste of power and damage to the machine.

Again, there is the far-sighted, or hypermetropic, eye, very generally misunderstood. Unlike presbyopia, which develops slowly and becomes evident at middle age, this is a congenital and permanent defect in original shape of the eyeball, which is not deep enough from before backward,—the retina is too close to the lens, intercepting the light before it has reached a focus; a perfectly healthy eye with a lack of proper relative position of its lens and retina. This would naturally cause all its pictures to be blurred and indistinct. But as all eyes have the muscular power for increasing the

strength of the lens, such an eye can, must, and does adjust the lens to the faulty position of the retina, and in that way sees perfectly well, but it has to use up more or less of its muscular power to get what the normal eye sees naturally and at rest. The far-sighted eye sees well enough, but not easily. The normal eye is like the rower on smooth water, who utilizes his strength only for progress and rests at will. The hypermetropic or ill-adjusted eye is like one rowing up-stream, who must spend much of his force in overcoming the ceaseless current, and has only the balance for real progress, and to him rest is impossible. The far-sighted eye is, therefore, of necessity, an overworked eye, not on account of what it does, but on account of its shape, for it has first to overcome its ever-present congenital defect, and in addition all the work of the normal eye as well. This constant, unavoidable work shows itself sooner or later in some form of fatigue or nervous exhaustion. There need not be the slightest impairment of vision or pain in the eye, but inability to enjoy continued vision without weariness, fatigue, slight nausea, headache, sick headache, neuralgia, sleepiness, or inability to fix the attention long at a time; or there may be local symptoms of blurring, smarting, aching, or tired feeling in the eyes. Whether or not the hypermetrope experiences any of these symptoms will depend much on his general health, his supply of nervous power, and the amount of close work done. He may escape them all his life, if strong and well; he may be made miserable in health by them, even while in school. Anything that lowers the tone of the system may cause the overtax to declare itself. Very often, however, since the hypermetrope never was able to compare his eyes with others, as to ease of seeing, he remains in entire ignorance that his sight costs him so much, and he may prove a constant patron of the physician for tonics and assistance to combat his various troubles, or else settle down to the belief that he must endure his discomforts as part of his make-up.

To properly care for one's eyes, therefore, one certainly ought to be sure that he was not unconsciously obliging them to bear the burden of a congenital error, and should know the signs pointing to such a defect. Suspicion should be aroused when one finds himself troubled by any of the above-mentioned symptoms or any form of nervous exhaustion, especially if it be noticed to follow continued use of the eyes, either near or far off. Hypermetropia may often be easily detected by testing how far off one can read ordinary print through a lens of known focal strength,—*i.e.*, if one looks through a ten-inch lens and can read clearly at a greater number of inches

than the focal length, say twelve, fourteen, or more, then he surely is far-sighted. The lens may be of any strength between six- and eighteen-inch focus, and should be kept close to the eye. The farthest point for distinct vision for a normal eye is at the focal length of the lens.

It is by no means necessary for every one who is hypermetropic to wear glasses, for, if he experiences no signs of nervous trouble or over-fatigue, it is perfectly safe to leave the matter alone, although theoretically he needs help. But the recognition of hypermetropia should put one on his guard, and would supply a positive diagnosis for many forms of nervous difficulty which might arise, and explain many forms of fatigue and disturbance liable to be laid to the brain, the stomach, the liver, etc. Glasses for the hypermetrope simply take off the constant burden at will, do the extra work for him, and give him as fair a chance as normal eyes have. They make him see not a particle better, but easier. They save his accommodation for its proper use, and should be worn enough to make his vision comfortable. Of course, presbyopia will make itself felt much earlier in the far-sighted than in the normal eye.

The third error, very common and but little understood, is astigmatism, another congenital error of shape, this time not of the eyeball, but of the cornea or clear front portion of the eye. The cornea, being a curved surface, acts with the lens as part of the refracting apparatus, and should be like all lenses, truly spherical, but unfortunately it is very often far from true. Most frequently the curve is stronger in the vertical direction than in the horizontal, and these different curves refract the light unevenly, so that the light as it passes through the lens does not all reach the same focus, —*i.e.*, when the light which comes in through the stronger curve is properly focussed, that coming through the weaker curve is not bent so much and is not focussed, so the picture is blurred or streaky. If the eye, by means of its accommodation, adjusts itself for the weaker curve, then the vertical light is not focussed. Such an eye surely cannot rest, for it has to be very active not only for adjusting for different distances, but varying its adjustment constantly, even at the same distance, according as it needs to see the vertical or horizontal parts of the outline; for example, letters being made up of lines in varying directions, the astigmatic eye sees only certain parts of a letter clearly at once, but by rapid changes of accommodation picks them out with difficulty one part at a time. This condition, being congenital, is rarely recognized by the owner except in decided cases, for, having learned as a baby to make the con-

tinuous changes in adjustment, and having been obliged to do so all his life, he knows of no other way to see, and supposes he sees naturally; but it costs his nervous system a constant amount of wearying fatigue, and is unavoidable. Using astigmatic eyes may in some senses be compared to riding with oval wheels; one can make progress, but there is much unpleasant jarring and very little ease. Here, again, the results of astigmatism show themselves in some form of fatigue, not in the eye usually, but as pain at the back or top of the head, or in any of the ways already mentioned. There may be hardly any recognized impairment of vision. Astigmatism is not so easily found by the owner of the eyes, but the simplest test is to look at a set of fine radiating lines with each eye separately. If some appear blacker or clearer than others, and change with movements of the head, this error is surely present. Glasses here can be made to even the irregular curves and give the person practically normal eyes to use.

Another very common source of annoyance is the inequality of the eyes: one eye perhaps normal and one somewhat defective. Since the eyes from their mode of enervation must always act equally and together, it follows that one eye does not rest, even if closed or covered, but moves and acts exactly with the other. Also, that if they start unequal by construction, no amount of practice will enable them to adjust themselves separately, but one will always be ill-adjusted and an annoyance, for the brain receives the two impressions, which are unlike, and tries to combine them. Here, again, glasses build the eyes up to equality and ease.

It is often objected that the muscles spoken of are so small, their power so insignificant, their work so automatic, that the annoyance of glasses must far out-balance the benefit, and that certainly a man in ordinary health should not miss the trifling nervous power needed to overcome such errors. But it is to be remembered that the hair-spring of a watch is quite as important as the main-spring, and its ill-adjustment affects the whole watch. It is not the amount of the work done, but the continued obligatory action that is the starting-point of the disturbance. Every muscle needs some rest, but in these optical errors there is no rest unless the eyes are closed or good vision abandoned. Rest to the hypermetropic or astigmatic eye means loss of focus and blurred sight, which will not be tolerated as long as one's will-power can hold out. Rest to the normal eye means rest, and yet perfect vision everywhere beyond fifteen or twenty feet. A blacksmith hammers all day with his heavy hammer because he rests between

the blows, but to hold a feather at arm's length for half an hour is next to impossible, and the attempt to do so would disturb him in many more ways than the tired arm, and involve the whole power of his will and attention to prevent the longed-for relaxation.

But fatigue in its many forms is not the only result of these optical errors, for an increase in muscular work anywhere means an increased call for blood, and this, kept up abnormally strong and long, tends to induce in many cases chronic congestion. In the eye this may show itself either in the lids or their appendages, or may result in deeper-seated, less visible, but more serious physical conditions. When this congestion affects the lids, it appears by smarting, pricking, gravelly or burning feelings after use of the eyes, or in sensations of fulness, heaviness, sleepiness, or nervous twitching of the lids. It may affect the edges chiefly and make them red and scaly, with more or less loss of lashes. All these symptoms in lids may also result from truly local forms of irritation, as will be mentioned later, but more often some optical error lurks at the bottom, and this should be strongly suspected when the condition recurs after relief has once been obtained by local treatment.

The position of the head often necessary in the work of the dentist may sometimes induce, and at least would greatly aggravate, the tendency to congestion. Unless he uses the mirror largely, a few moments of erect position, thrown in frequently, would do much to avoid trouble.

The common complaint and anxiety in regard to floating black specks or spots is usually due to slight and temporary congestion of the back of the eye. In themselves these spots mean little or nothing, unless they are very abundant, large, or persistent. They are but the shadow of little particles which are present in the fluids of almost every eye, but the healthy eye does not notice them. If, however, from indigestion or any other cause, or more frequently from the ever-present strain of the overtaxed accommodation, congestion of the deeper parts of the eye is induced, then the retina becomes sensitive and irritable and notices them. Just as the sore finger seems to come in contact with everything, yet it is only because it is more sensitive that it demands attention to the touches usually unheeded.

Photophobia, or dread of light, is another symptom of the same sort. Very often it is only a sign of irritation from some optical cause. Though this dread of light is present in nearly all inflammatory diseases of either the front or back parts of the eye, it is

usually then accompanied by other more serious symptoms, as pain, tenderness on pressure, glimmering, flashes of light, dark clouds in permanent positions, impairment of sight, or some evident external signs of trouble needing medical advice. Just as the tired, overtaxed person becomes nervous and irritable and is fretted by trifles not ordinarily noticed, so the eyes, tired and doomed to constant unnatural work, become sensitive and annoyed by many things unnoticed by the properly adjusted eye. When the eyes are normal in action and have no local diseases, it is seldom that they object to severe and long-continued work, even if the general health is far from good, for they do get some rest. It is the weak links with flaws in them that give out under strain, and if the eyes begin to grumble there must surely be a reason. It is well, therefore, for every one who uses the eyes much to heed the early signs of fatigue or nervous irritation felt anywhere and see first whether, as is very likely, there is not some abnormal friction in the working of the eyes, which can be so easily and surely found, proved, and corrected, rather than search among uncertain possibilities elsewhere, or deny himself the free use of so valuable and willing servants. For if we review for a moment the long list of results following optical errors, smarting, burning, gravelly sensations, reddened and irritable eyelids, weak, tired feelings, headache, sick headache, pain in the eyes, blurring, twitching, sleepiness, itching, etc., etc., we find strangely that they include nearly all the complaints that are usually made, and experience proves that these errors, though not the only possible causes, are the most frequent and likely.

The question why there are so many defective eyes found nowadays deserves a moment's consideration, and has two answers: First, we know that in the organic world nature always works towards a perfect pattern in shape as well as function, but seldom attains it, and the result is infinite variety with but slight variations. Now, in all other instances, exactness of shape or form is not a necessary requisite for health or perfect function, but in the eye, as an optical instrument, it is the perfection of the curves and the accuracy of position of lens, cornea, and retina that give the perfect function of producing accurate pictures for us to see. But variations from the perfect standard are nearly as common in the eye as in the features or elsewhere in the body, and here interfere directly with the value of the organ; the burden of overcoming the fault falls upon the muscles of accommodation, which do their very best till compelled by exhaustion to complain. There is therefore

nothing strange in the prevalence of such errors. Secondly, experience is unexpectedly showing the results of this overstrain and tax to be so varied and far-reaching that errors are looked for now where a few years ago they would not have been suspected, and the key to many a puzzle is found. This must be my apology for making this the prominent part of this paper; and yet there is one other reason, namely, the fact that both hypermetropic and astigmatic errors can be detected, measured, and proved by strictly objective or mechanical means, and thus there is no chance for doubt as to diagnosis. Errors cannot be found where they do not exist, though it is of course possible to overlook slight ones, and if errors are found the results are inevitable. Yet the mistaken idea which is so prevalent is that there must be some impairment of vision if error is present. To see well is one thing, but to see well and easily is quite another.

Myopia, or near-sight, has been purposely omitted, for, being in some sense a disease which affects the eye in childhood and youth, reaching a stand-still usually at the age of twenty-two or twenty-three, the time for attention to that form of optical error is while it is in progress and more or less amenable to care and treatment, and therefore is not of importance for you now. After myopia reaches its fixed condition, though a misfortune in many ways, it is not wholly an unfavorable one for the dentist, and does not lead often to trouble, unless complicated with other errors or of high degree. Myopia really is the giving way or bulging backward of the abnormally weak back part of the eye,—the eyeball becomes too long or egg-shaped, thus carrying the retina beyond the proper focus of the lens, and, there being no power of weakening the refraction, distant vision is permanently impaired. Contrary to the popular belief and the comfortable hopes of many, vision does not improve with age. Presbyopia comes on as usual, but is modified by the condition present, so that glasses for reading are not needed as early as usual, or in some cases never needed. This gain, however, is offset by the life-long loss of distant vision.

There are, of course, very many cases where the conjunctiva lining the lids or their edges may show simply local forms of congestion, interfering greatly with their comfort, and brought on by various causes, such as exposure to excessive light, dust, wind, smoke, close air in ill-ventilated rooms or crowded halls, or, indirectly, by long-continued work with insufficient light, lack of exercise, etc., but such cases are apt to be temporary and vary with the action of the cause. All these symptoms are aggravated by

close work or by artificial light. There is quite possibly even here some slight optical error that only prepares the way for the influence of these as secondary causes. Where none is found, the simplest remedies for the smarting, itching, fatigue, etc., are the use of mild astringent washes, such as the ordinary borax wash, ten grains to the ounce of water or camphor-water, or in more pronounced cases from one-half to two grains of sulphate of zinc instead of the borax; these applied three or four times a day. Also, the application of heat or cold, as may be most agreeable. These latter remedies, however, need to be used properly, for they are more powerful sometimes than is supposed. The object in these cases is, of course, to reduce congestion, and although this may be accomplished either with hot or cold water, the exact opposite can also be done with either, so that simply to advise heat or cold might result in anything but relief. For example, if the hand be put into very cold water a short time only and then removed, the reaction is so strong that very soon the hand becomes red and hot or congested; if, however, it is put into cool water a little below the temperature of the blood, and left a little longer, there is no reaction, but the temperature is lowered and the blood driven away for quite a little while. So also with heat; warmth draws blood to a part, but stinging heat acts powerfully in reducing congestion, and, as is well known, is a very valuable aid in checking hemorrhage. Therefore, stinging hot water should be used to bathe the eyes, or, if preferred, one or two thicknesses only of cloth wet in cool water laid over the eyes and kept wet, so as to gradually abstract heat by evaporation. Warm water only increases the flow of blood, and a pad of cloth wet in cold water quickly turns into a warm poultice. Position, also, has much to do with the result; if the head is bent down over the bowl and the water splashed upon the eye, both the position and the shock of the splashing tend to produce congestion, and the effect of the application is annulled. The hot water should be applied on a large cloth or sponge, with the head erect or reclining, and gently laid in the eyes and kept quietly there as long as the stinging heat remains, then renewed. This is a very refreshing application to tired eyes and head, but of course should not be used too frequently. Often a congested or swollen state of the conjunctiva, by extending into the fine tear-ducts, causes a very annoying overflow of tears, especially in bright light, wind, or when the head is bent forward. Patient use of mild astringents and occasional application of heat, with the removal of any discoverable cause for the congestion, optical or otherwise, will usually bring

about relief, but in many cases there is a real contraction or obstruction of the ducts, which, of course, calls for local treatment.

In regard to artificial light of various kinds, it is necessary simply to remember its prominent differences from daylight. Daylight is diffused light, proceeding, of course, primarily from the sun, but every object and the whole sky become also sources of illumination, so that the light is more even and shadows much softer. Direct sunlight we seldom permit to enter the eye. Artificial light is vastly less intense, so that the retinal pictures are much fainter and tax the seeing power of the eye more; and also, for the same reason, the pupil of the eye has to expand greatly to let in more light. This large pupil, from optical necessities, makes the focussing of the light less accurate and clear, just as in a camera the small stop with brilliant light will give the best defined pictures. Again, the light usually comes from one or more brilliant sources not far off, and direct light from these is apt to enter the eyes, or perhaps only one. This annoys and worries the nerves controlling the size of the pupil, for there is a distracting desire to dilate for the dimmer parts of the picture and to contract on account of the strong light from the flame. It is not the quantity of light which is apt to fret the eye, but the inequality in the illumination. Strong contrasts are fatiguing: a streak of sunlight on a light wall is more fatiguing than full sunlight over the whole surface, for the eye can easier accommodate itself. From this it follows that the sources of artificial light should not be visible while at work,—no direct light should get into either eye. With this point attended to, the more light the better. The preferable position for the light is above and a little behind the head. As to the kind of light, the important points are brilliancy and steadiness. Arc lights fail greatly in steadiness and so are not good for close work, and their excessive brilliancy makes their direct rays very trying. Incandescent lights, if shielded, are as desirable as any known, for they have brilliancy and steadiness and the additional advantages of lack of heat and contamination of the air. One other peculiarity of artificial light is the predominance of the yellow rays, which are more irritating to the retina than the mixed white light. For this reason sensitive eyes often find great relief in using a chimney or shade of a very light blue tint; this neutralizes part of the yellow rays and gives a whiter and more agreeable light, like daylight.

The influence of tobacco perhaps deserves a moment's notice, though, probably on account of moderate use, but few in the dental

profession run much risk from this cause. Still the danger from it is often so insidious and depends so little on what is considered an excessive use, that it is well to understand the matter clearly. Tobacco, as is well known, not only has its pleasant qualities which win so many adherents to its use, but it has very active poisonous qualities, which the system only learns to tolerate, just as it does opium, arsenic, and many other deleterious substances. It depends entirely upon the variable ability to absorb and eliminate the poisonous elements. If one absorbs a certain quantity daily, and is able to eliminate the same, the effect of tobacco will not be likely to be harmful; but if from any cause, or at any time, the power of elimination falls below the amount absorbed, then the system begins to be loaded or saturated with the drug, and, like a tank with ill-adjusted inflow and outflow, sooner or later it will suddenly overflow,—that is, unexpectedly the system will begin to suffer somewhere from the accumulated absorption of a long time. In the case of tobacco it may be the heart, the digestion, or the nervous system that will suffer first, or it may be the optic nerve will feel the full force and begin to wither and atrophy. If so, vision begins to fail in both eyes, everything acquiring a smoky, hazy look. This steadily increases without pain or annoyance, and unless one attends to it and the process is checked before it gets much headway, permanent loss of vision is quite sure to result. The danger is in its gradual, stealthy progress, without pain or symptom calling attention until vision is much impaired, and this, in those who have long been users of tobacco, and perhaps in only moderate degrees. The evils of the use of tobacco come, therefore, not in those who are beginning its use, not necessarily in those using it to excess, but in any one, at any time, whenever from one cause or another elimination is impaired. It is especially apt to show itself when the condition of the system is lowered by loss of sleep, anxiety, trouble, or decided change in habits, or by the habitual use of stimulants. The treatment is entire cessation from tobacco in every form, so that the whole power of the system may be used for elimination. One can usually retain what vision he has left when he commences treatment, but not surely.

On the whole, the eyes are much like other parts of the body, —when they are in order, we use them, hardly knowing that we have them, thinking little how they do their work, unaware of the many intricate processes and marvellous accuracy involved. Looking out over a broad landscape, or any comprehensive scene, one seldom realizes that the whole picture in the eye is but about

an inch square; or as one looks across a broad street and recognizes an acquaintance, noticing all the minutiæ of his expression and dress, down even to the cord of an eye-glass, it is difficult to comprehend that the real picture seen is only as large as the letter "i" in small print. Any one who has used a microscope will understand what nice adjustment is necessary for such minute pictures, and, as we are constantly looking at objects at varying distances, and have to adjust rapidly, yet perfectly, for each slightest change, and, moreover, have two eyes and two pictures which must fall on exactly corresponding portions of the retinæ, or else give rise to very distressing double vision, also having to follow moving objects receding or advancing,—with all these complications, it is not hard to perceive that the work of the muscles of the eyes is not only very nice but very lively work. It is really remarkable how well and how untiringly fairly normal eyes do all this without fatigue or complaint. But if in addition they are burdened with additional obligatory and continuous work on account of congenital errors of shape, even then they do their best, but sooner or later the system feels the strain and has to pay the cost of the overtax.

Since normal eyes do so well, and so rarely complain, surely it is worth while to take some thought as to their proper care, heed the early signs of fatigue as one would the squeaking of a machine, and relieve it, if possible, not by stopping its use, but by removing the annoying friction. It is by no means claimed that the overtaxing of the muscles of accommodation is the sole cause of all the symptoms of nervous fatigue, but it is surprisingly often the exciting cause. The lowered tone of the general health, and the prevalent over-sensitive condition of the nervous system, are generally prominent elements; but granting this, it must still remain the surer plan, if even adopted as a temporary remedy, to reduce by positive means the unnatural strain inevitably caused by these optical errors, rather than seek by uncertain methods to build up the health to the ability to bear the unnecessary burden.

DISCUSSION.

Dr. Williams.—I wish to express my gratification for the privilege of listening to a paper so scientific, and yet so plainly expressed. The subject is one of great importance to us all, and, though I have not made an especial study of it, the principles referred to by the speaker seem to me perfectly sound. The essayist, speaking of rest and intermittent rest, reminds me of a remark that I heard Dr. John C. Warren make when he was professor of anatomy, in 1844,

to the class in which I was a student. He said, "When you are doing an operation lasting for half an hour or more, the eyes will sometimes become blurred as a result of close application, and it may be difficult to see without making an extra effort. At such a time you may do harm by forcing the eyes, and it is better to let them rest on some other object for a brief period, or step to the window and look out for a moment or two. In this way the eyes are refreshed, and you can see as well as ever, and by constantly observing this rule there is no danger of exhausting them." The essayist has embodied that principle in his paper, and shown us that rest must alternate with work in order to gain or keep strength. This has proved an invaluable principle to me. Whenever my eyes become tired, not exhausted, I let them rest for a minute on a distant object.

With regard to light reflected into the eyes, we certainly expose ourselves to many disadvantages from light-colored objects and polished metal surfaces. As the essayist says, the light should not enter the eye, but should be a little above and at the back of the operator, in order that he may work with the least effort. Dr. B. S. Codman told me some years ago that he was obliged to give up the practice of dentistry because he found that looking at white teeth seriously affected his eyes. Whether or not that was the first cause, it showed the fact that a constant use of the eyes upon light objects does affect the sight. Some dentists and surgeons wear white operating coats which reflect the light which strikes them, and have about the same effect as a snow-bank under their eyes. Polished metal surfaces and white napkins are likewise to be avoided. We should have the latter shaded a little, so that the light will fall upon the object you are operating on, and not be reflected into the eye.

Dr. Potter.—If I understood Dr. Dixon, he recommended the incandescent as superior to any artificial form of light that we have, and I would like to ask him how the incandescent lights can best be prepared,—whether the ordinary fixture, the plain pear-shaped bulb, is proper for either reading or working, or whether that is too bright? It seems to me that there is too much glare, and that the bulb ought to be surrounded with a ground-glass case in order to take off the brilliancy. It has always been my impression that the pear-shaped globe was rather more trying than some gas-lights.

Dr. Dixon.—The principal point is to so place the bulb that, as you work or read, you cannot see the filament. If it is above or back of you, or placed in any way so that direct rays from the

filament do not strike the eye, then the more light you get, the better. It is the direct light from the illuminated source that annoys.

Dr. Williams.—Another point occurred to me, and that is the use of lenses to which the essayist refers. I was taught as a pupil not to imagine that my eyes were microscopes, but to take advantage of the use of the magnifying-glass for looking at small things, just as jewellers, watchmakers, and engravers do, and I always carry a small magnifying-glass with me. I have often operated with a lens on my finger, as an engraver does, and have found its use to be of great service to me. There are aids which civilization affords us, and if we adopt them we certainly have the gain. The young Alpine tourist, in going up the mountain, will always take with him his mountain staff, even if his muscles are all strong and sturdy. That idea of working under magnifying power I once saw put into practical operation by a dentist who used a stand which supported a large, round magnifying-glass, through which he looked into the mouth of the patient and worked as an engraver does. He was formerly an engraver, and after becoming a dentist, and trying for some time to get along without a glass, he was satisfied that he could not do as good work without it. Students should be taught to use a lens, and so improve the quality of their work.

President Seabury.—I was advised, when a young man, to use glasses as soon as I found they would help me, and, realizing the necessity of clear sight in my profession, I resolved never to let my sensitiveness override my needs. The person who advised me said, "Don't wait until you are forced to wear glasses, but put them on as soon as they will help your eyes. Then your eyesight will last longer than if you delay till there is an absolute necessity." I have with me to-night my working-glasses, the upper third of which is cut off so that I look through them only when I look down at my work. When I look up I use my natural sight. This arrangement of my glasses involves the principle of alternate rest and use, about which the essayist has spoken, and is very satisfactory to me.

Dr. Werner.—The lesson we derive from the essay of this evening is, that we cannot be too careful of our eyesight. To me it is very plain why the average practitioner finds it necessary to use glasses at such an early period of life. Among the causes, as Dr. Williams has suggested, are the bright materials with which we work and are surrounded,—as, for instance, light operating coats, polished and shiny metallic surfaces on our apparatus, the white

surfaces of the teeth. These things demand a constant nervous and muscular co-ordination of the eye. Besides, some dentists read at all times and in all lights, even when travelling on railway trains and horse-cars. Every dentist should have a distant outlook from his operating-room, so that the eye may be turned from the near work and rested on a far-away object. We dentists live in small, ill-ventilated operating-rooms for a considerable portion of our lives, and hence it is that so often dentists look pale and haggard, lacking the bright, rosy color of the physically healthy man. Physiologists tell us that the exhalations from the lungs contain a product of decomposition that when reinhaled is very poisonous to all animal life; that it will kill in a very short time, even coming from healthy lungs. How much worse its effect when coming through mouths that are diseased and ill-smelling! We need large operating-rooms with ventilation through a fireplace and windows so as not to live in an atmosphere of exhalations.

Dr. Taft.—I should like to ask the essayist if, in his opinion, a fatigued condition of the system brings about a dimness of vision in the hypermetropic eye quicker than in the presbyopic, and in what condition of life dimness would be most apt to manifest itself? I seldom feel any fatigue myself, although I use my eyes very constantly, and work, perhaps, as little with the mirror as almost any man. I know it is not a good thing to do, and have thought that, while feeling but little fatigue, perhaps by the continued strain upon the eyes I may be abusing them.

Dr. Dixon.—In simple presbyopia the fatigue is felt only after the age of forty, and it then manifests itself by a dimness of the vision or weariness when engaged in near work. If one does not tax the eyes too much, no serious trouble may be looked for. But in hypermetropia the person is, of necessity, under constant fatigue. As long as his nervous system is able to bear it he may continue using his eyes without noticing any trouble, until some extra demand on, or decrease of, his nervous power makes the defect become prominent. People of sound constitution may have hypermetropia all their lives without inconvenience, and it only comes to their knowledge by having the distant vision fail somewhat when over fifty. All those people who can accept a convex glass and see better with it at a distance have been hypermetropic all their lives; and if they had known it they could have saved their eyes a great deal of unnecessary labor.

In regard to reading in the cars, the only point to remark is this: a normal eye will stand almost any amount of work without

becoming fatigued. It is the imperfect eye that gives out. A perfect eye can read in the cars a good deal without serious fatigue or strain; it is able to bear it, though I do not wish to be understood as recommending this practice, for we are not all blessed with perfect eyes, and one might attempt to use an eye with an error so slight that it would be very difficult to find, but which nevertheless would soon give out. As I stated in my paper, the astigmatic eye and the hypermetropic eye never have any rest except when the eyes are closed, and it is the never-ceasing work which they are compelled to do that is at the bottom of the whole trouble.

Dr. Harris.—I would make a motion that the thanks of the Academy be extended to Dr. Dixon, for the very interesting and valuable paper which he has read before the Academy this evening.

Dr. Fillebrown.—I second the motion. I have made no remarks upon the paper, though I have thoroughly appreciated its excellence, and I have learned a great deal more about a pair of eyes that has done good work for a great many years than I ever knew before.

The regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms on April 1, 1891, Vice-President Brackett in the chair.

The paper for the evening was read by William Barker, D.D.S. Subject, "A Discussion of the Fee Problem."

A DISCUSSION OF THE FEE PROBLEM.

BY WILLIAM BARKER, D.D.S.

Practitioners of dentistry may be likened to travellers on the high-road of ancient Thebes, to whom the Sphinx propounded her riddles.

We cannot long travel the high-road of dentistry without encountering the Sphinx, who will propound to us, not a veritable riddle, it is true, but a problem on whose satisfactory solution no small degree of our peace and success must depend. It is the fee problem. Fortunately for us, our modern Sphinx imposes no death penalty for failure to solve the problem, and we are permitted to pass on, ever revolving, and, as yet, rarely solving the problem either to our own or the entire satisfaction of all our patients. Œdipus, we know, solved his riddle, whereupon the Sphinx destroyed herself.

We have no expectation of discovering to you a modern Œdipus, and only hope to say something which may help to place the whole question, if possible, on a more nearly scientific basis than it at present occupies, for we are persuaded that in a matter involving the reciprocal obligations of performer and receiver of professional services, there may be some way of arriving at an equitable, and possibly scientific, theory of adjustment of the ever-recurring problem of where the claims of a performer of professional service to remuneration cease, and where the obligation of the recipient of the service is discharged.

It is admitted at the outset that our problem contains factors so numerous, varied in character, and uncertain of validity, as to make a strictly scientific balancing and adjustment of them reflect itself in an equation, in any given case, not only exceedingly difficult, but perhaps impossible.

The conundrum of the street or club we may decline to consider at all, or, if found too difficult on consideration, we may give it up; but when any act or procedure in which we are participants, and of which goodness or badness, justice or injustice, may be predicated,

is presented for our examination, as moral beings we may not absolutely decline its consideration because of its perplexing nature or the apparent hopelessness of arriving at a correct solution. Remembering how many problems of science, of geology, of astronomy, chemistry, or music have only been solved after many years, and as the result of the connected efforts of recurring generations of students, we may serenely proceed to the study of our theme or problem, confident that the truth, if any shall be presented, will be garnered, and the chaff of error be scattered by the winds of criticism.

If John Doe, as a farmer, ploughs, plants, and tills a field for Richard Roe, and receives remuneration therefor, he is said to be an earner of and a receiver of wages. If John Doe, as a lawyer, draws a will or prepares a brief for Richard Roe, or if, as a physician, he tends him during a fever, or if, as a dentist, he fills his tooth, removes a ranula, or constructs for him an artificial denture, and receives remuneration therefor, he is said to be a professional man, and as such, to be an earner of fees. Why this distinction without any essential difference it would be interesting to know.

The word fee, in the sense in which we here use it, as payment for service, is a word of Scotch origin, meaning cattle. Cattle were used as currency, or a medium of exchange, in the same way that peltry, shells, gold-dust, and other articles of general desire or value, have been employed by rude and primitive people at various times. Cattle, or fe, fee, fey, fie, feoh, were essentially money, as we now use the term and employ the article, and when service of any kind was rendered, it was paid for in fee or in cattle. How the term came to be restricted in its use as at present, we have been unable to ascertain. We apprehend, however, that the distinction in terms, without any essential difference in meaning at any rate, is perpetuated, and finds its chief support and value for many in the fact that in the *popular* mind a more or less hazy idea exists that somehow more honor attaches to the earning or receipt of a fee than to a wage or salary.

The term fee *is*, however, employed as descriptive of remuneration for a much larger and *less* honorable class of services than at first thought is apparent. Lawyers and doctors, horse doctors and corn doctors are paid in fees. Whoever performs the marriage ceremony, be the person a church or civic functionary, is paid in a fee. Court officials are very generally paid in fees. Pilots are paid in fees. We are said to fee the waiter or the chamber-maid, and when we conform to the porter's idea of a *real* gentleman we bestow a fee,

while the stud stallion, the herd bull, the autocrat of the kennel, the monarch of the sheep-fold, and other domestic animals kept for breeding purposes are, in that capacity, said to be earners of fees for their owners.

Nor is the fee, as is quite commonly supposed, arbitrarily fixed by law or custom as payment for a definite service. John Doe, the farmer, receives wages according to the size of the field he tills or the time he works.

The fee of John Doe, the lawyer, is supposed to correspond, approximately at least, to the length or difficulty of the will or other document he draws, but it is commonly modified by the ability or willingness of his client to pay, or, what is the same thing, is gauged by the *value* of his services to his client.

What we desire more particularly to examine, in this paper, is whether the price, or fee, which is demanded for a service should be gauged by its *cost* or its value,—*i.e.*, should cost be the limit of price, or should value be the limit, or a factor even, in determining price?

The adoption of a standard of weights and measures secures not only a ready means of determining the exact relation of quantity existing between two or more portions of any material, but it *helps to secure*, as a secondary result, in the vast bulk of commercial transactions, substantial justice between buyer and seller. Poor judgment, innocence, inexperience, or even ignorance, finds in the standard a ready means of determining the exact quantities, if not the relative *values*, of commodities to be exchanged without being compelled to assume a defensive or suspicious attitude against chicane or unscrupulousness.

We say the standards of weights and measures *helps to secure justice* in commercial transactions.

A standard *based on equities* is required, however, to supplement the material standard.

Let us employ an illustration to make our meaning clear:

Eliminating needless factors and complications, let us assume Brown and Jones to be men of equal natural capacities in all directions. Equal application to any given occupation or art would result in equal efficiency in each. They are both fishermen. Brown, influenced by environment, devotes *his* time and energies to catching cod. Jones, likewise determined by his environment, catches bass. Should they desire to ascertain the relative weights of a cod and a bass, recourse would naturally be had to the scales as a standard of weight.

If we now suppose them to be catching fish for their own consumption, there being no outside market, and that neither is content with one variety of fish, and they desire to exchange with each other the catch of any day or week, what ought to be the basis on which the exchange should be made?

To use the scale now would only be to determine the relative weight of the two catches, not assisting even to determine their relative *worth*, which must be determined by a different standard.

Is it not apparent that, as between these two men, if neither is to gain any advantage over the other, if one is not to get something for nothing, while the other is to get nothing for something, the exchange must be made on the basis of cost? And supposing the amounts of cost, measured in time, wear of tackle, etc., and repugnance overcome, to be equal, one week's catch of cod ought to exchange for one week's catch of bass.

In such a case as we have been supposing, it would be an easy, and in time probably a natural, step for Brown and Jones to establish and recognize, for convenience in exchanging less than a week's or a day's catch, a relation of value compared conveniently in weight, but really measured in cost of production between the two kinds of fish, in much the same way that the relative values of gold and silver are established by law,—about one to sixteen.

At bottom, the relation is seen to be based on relative cost of production. A given amount of labor applied to the production of gold yielding one, and an equivalent amount applied to the mining of silver producing sixteen, those quantities are said to be equal in value, and exchange freely on that basis.

Cost, then, if it can be ascertained, furnishes an equitable and approximately if not a perfectly scientific measure of price.

To say that a thing is worth what it will bring, to employ the language of the market, is to say not only that value is, but that it should be, the measure of price; is to say that we may, because we can, demand from a famishing man for the measure of wheat which has cost us an hour's time and labor, and the overcoming of some slight repugnance to produce, a price equivalent to many hours or even weeks of time and labor and the overcoming of intense repugnance.

The necessities of the would-be consumer of our wheat is a factor we have not to consider, and may not take advantage of. To do so is to get something for nothing; is to appropriate as an idler, and by means of essential compulsion or duress, to our own use, the rewards of another's industry.

The ability or willingness to pay, or the necessities under which a purchaser rests, we repeat, are not factors which the seller has a right to consider or take advantage of.

The practice which many dentists more or less covertly pursue, as they say, "sizing a patient up," to estimate how heavy a fee he will stand, of course violates the equities, and places the adjusting of fees on the low plane occupied by the bully, who overrides the rights of all not bold enough or strong enough to thrash him.

These same men expect to pay no more for a pound of steak or sugar, for a book of gold, or an excavator, than would be demanded of a day laborer or a poor student for the same thing. "One price to all" is not the general commercial practice because of its convenience so much as because of its justice.

In fact, when we study the subject and familiarize our minds with the equitable harmonies likely to grow out of the general adoption of the cost principle of price, and contrast it with the injustice, the blunting of moral perceptions, the fostering of greed and avarice, and the embruiting exaltation of self at the cost of others' necessities, involved in the adoption of the principle that a thing or a service is worth what it will fetch, or that value should be the measure of price, we are convinced that, as a rule or standard for the fixing of fees, the cost principle would prove itself valuable, convenient, scientific, and satisfactory alike to all patients and operators who believe in reciprocity of service and mean to practise the virtues involved in a *quid pro quo*.

We have here indicated a *rule*, the general adoption of which by buyer and seller, between the performer and receiver of service, would tend greatly to increase the sum of human happiness, and to check, in great measure, the growth of those two classes so dangerous to modern civilization, the millionnaire and the tramp, would tend to abolish involuntary poverty, and make the fear of poverty by the industrious a shadowy dream.

A word as to the obligation imposed on believers in the cost principle to put it in practice.

At the first blush it seems to be an *inexorable law*, binding on the conscience and demanding instant obedience; as if no man unwilling to receive more benefits than he confers could continue to receive profits, or, more accurately speaking, could longer continue the practice of fleecing his patients or patrons.

This impression will vary with the varying mental and moral make-up of different individuals. It becomes a question of casuistry

which each must decide for himself. "Absolve thee to thyself. Nothing is finally sacred but thine own integrity."

"In the first place, let us remember that it is impossible, in the nature of things, to apply a principle the essence of which is to regulate the terms of reciprocity where no reciprocity exists."

The equitist, who should sell on the cost principle and be compelled to buy where that principle was ignored, would soon be compelled to put up his shutters, and the campaign for justice and reciprocity would be waged, if at all, without him. Conservation of one's own energies is essential in a long race and a protracted fight. He who wars against the world single-handed, he who swims against the current alone, is likely to sink, without affecting aught save useless labor and sinful sacrifice.

The farmer living in a section of country overrun with Canada thistles, who should attempt to exterminate them from his own farm by confining his efforts to his own acres, might be expected to succeed as well as he who should attempt to inaugurate a system of fees based on the cost principle, but which none, or few others, in the community appreciated or recognized.

If we have thus far made our meaning clear, we shall perceive that the fee which may be rightfully demanded for a dental service will be, ideally, an exact equivalent for the time, labor, skill, and repugnance overcome in the direct performance of the particular operation, also the time and labor, or their equivalent, *indirectly* expended or consumed in the performance of the service while pursuing preparatory studies and acquiring the requisite qualifications to perform the service at all. If, reckoning in each and every factor legitimately contributing to the perfected service, we find it represented, say, by twenty, then that is the measure of the fee we may demand, no more no less.

The president of one of our leading universities, in a recent public address on socialism, expressed the wish that the hope of the socialists could be realized, but affirmed his disbelief in the practicability of the doctrines, because, among other reasons, as he thought, of the impossibility of arriving at the labor cost of productions.

While we admit the force of the objection and concede the impracticability of reaching in every case an exact measure of the absolute and ideal cost of dental operations, we yet contend that an honest *attempt* to do this is much more likely to secure the measure of an equitable fee than is the too prevalent method of sizing a patient up by the clothes he wears, the house he lives in, or the equipage he drives.

We contend, *at least,* for a reasonable correspondence between cost and price.

Criticism will converge upon the word reasonable. What is to be considered reasonable?

An excavator twelve inches long all would agree was too long to be convenient, while one only three inches long most of us would think too short to be useful; and while as to the length of his excavators as well as to the amount of his fees each dentist will and should be his own judge, yet in determining the amount of his fees he should be governed by other considerations than his own narrow interests or desires. It must be borne in mind that cost is the rightful limit of price.

We are of the opinion that twenty dollars per hour violates a reasonable correspondence between cost and price in one direction, and that two dollars per hour violates it in the other direction; fifteen dollars per hour, as a constant price, we are inclined to opine still violates the reasonable correspondence we are contending for, while ten dollars per hour as a constant price comes in our opinion perilously near it. "Let every man be fully persuaded in his own mind."

We think the time basis of fees, as a rule, can be made to more nearly harmonize with the cost principle of price than a system based arbitrarily on minimums, or the size of cavities, or the materials employed, or all combined.

We believe it to be inequitable, as well as unbusiness-like, to tacitly or openly and avowedly perform any beyond the most trivial service without a fee, with the covert or open intention of "getting square with them" at some other sitting, or, as we have sometimes heard, of getting it out of somebody else. Let every tub stand on its own bottom.

If we extract teeth and insert artificial dentures, let each be the subject of a fee, as much as would be the case if we amputated a leg and supplied a cork substitute, or dug and walled a cellar and afterwards erected a house over it. The busy dentist unquestionably should receive a fee for broken appointments, for a reason so obvious it need not be indicated. Fees for services to children, if conformable to the cost principle, should at least be as large as for adults, because of the ordinarily greater degree of repugnance overcome in serving them.

Conformity to the cost principle would very generally considerably increase the fees for work on devitalized teeth and for cleansing. The disproportion between cost and price for services

in regulating, to the average dentist, has always been cause for legitimate complaint.

But our object is not to discuss specific cases, but to unfold a principle by reference to which cases may be adjusted as they arrive.

One thought more. The exaction of too high fees, not only drives patients away from the practitioner exacting them, but not infrequently influences them to forego the benefits of dentistry to a harmful extent. Flying from the competent and honest operator, but dishonest fee-maker, the tendency is towards the quack operator and quack fee-maker. Scylla on the one hand, Charybdis on the other, as they make the course. Many, it is true, wisely steer the middle course, and are faithfully served as to operations and honorably dealt with as to fees.

A reasonable correspondence between cost and fees, if not in every case swelling the purse as would a fee violating that correspondence, on the high side, will yet, to the equitist at least, yield reasonable satisfaction and greatly tend to enlarge the field over which the benefits of dentistry shall be enjoyed.

DISCUSSION.

Dr. Brackett.—Gentlemen, you have heard the paper of Professor Barker, showing plainly, what some of us have appreciated before, that he is a student of social problems. He is especially known in Rhode Island as a profound student of social and economic questions, and he has made this the basis of a special application which certainly has been most interesting and suggestive for us. The paper is open for discussion.

Dr. Fillebrown.—I was much interested in Dr. Barker's paper. I did not quite understand, however, how one point would be met. It could be stated thus: Persons who may be well known to us, and whom we may desire to help, come into our office having some trouble with the teeth; we cannot allow them to suffer pain,—something must be done for them, but they have no means to pay, and we know it. The operation is going to take as much time as if we were paid for it, but we cannot turn them out and let them suffer. For humanity's sake we are bound to do something to alleviate that pain, and we cannot do it unless somebody else pays for it. This is an extreme illustration, but I did not hear such a case touched upon in the paper, and would like to have it explained.

There is another point, but perhaps that is covered by the idea of cost. One man is naturally much more skilful than another,—

he can do an operation very much quicker, easier, and the results are better than those of another man who has to give twice the time for the same work. In the case of the skilful man, on account of his natural quickness and intelligence, the total cost of time and materials might be represented by five dollars, while in the other case the cost of it might be represented by twenty dollars. Now, ought the one who has performed the same amount of service with less discomfort for the patient accept a sum which represents the cost in time to him?

I am heartily in sympathy with the working of the social problem and the bringing it into practical use, but one cannot go to extremes while the general average of the world is so far behind in the practice of the system. I would like to hear how socialists, through social glasses, view the question of the charitable work that we are called upon to do. It seems to me that all our hospitals, dispensaries, and so forth, are based upon the supposition that the rich are quite willing to pay the fees that shall enable each man to do his share towards helping those who are less favored.

Dr. Williams.—The matter of charging by time is of modern origin, and many dentists make it an absolute gauge for fees. It was established about the time of the war, when things began to boom generally. I have never brought myself to making that the main consideration, for several reasons. In the first place, I have always believed in the fact that Dr. Holmes once stated, that the most healthy man does not feel equally well at all times in his life. Therefore, if you try to give the same amount of effort every day, you do violence to your constitutional stock,—you have to draw on your principal, as it were. Bearing this fact in mind, I have made it a rule to work as I feel. I would not feel as the plumber or the locksmith, that I was obliged to do just so much work because I was paid for so much time, but I would do the thing well if it took me twice the time, and I would charge for what I did. In some cases I have charged about as much as the highest fee Dr. Barker mentions for about half an hour's work, and in other cases my charge was probably not more than the lowest fee. I calculate mainly on what is done for the patient, taking the matter of time as a secondary consideration. I should not, as an orist, charge like some other specialists. For instance, I have known of a case where an aurist charged ten dollars for painting the back of the ear with iodine. It could not have taken much time,—I should think not as much as to take out a tooth, which I would charge a dollar for.

It has never been my custom to make just so much every hour of my time, and I get along better mentally, physically, and, I think, more conscientiously than if I charged only by the time.

Dr. Fillebrown.—I made it a point not to antagonize the speaker in any way, but to draw forth a still further explanation of a part of the problem that bothers me. I should be glad to see the condition of society described in "Looking Backward" entirely realized here,—we could all of us live easier and better as far as our physical comforts are concerned, though we cannot tell what the effect would be on the moral and intellectual health. I heard of a case to-day that illustrates one phase of what I was alluding to. A gentleman told me of a friend of his who had had considerable dentistry done. At one time he was under the care of a dentist for more than a year for the treatment of a single tooth, and had been in trouble all the time. The patient then called on another dentist, and within two or three visits the tooth was cured,—made entirely healthy, and has remained in a healthy condition ever since. Now, if you are reckoning by the cost, the first fees were too large for the benefits which accrued; if estimated by the amount of good done, in the second case the fee was very small. There is the trouble in all these things. It seems to me that, under the present constitution of society, the principles laid down in the paper cannot be carried out. If we would all join hands at once, something might be done, still I don't see how we could overcome the question of natural aptitude. Under certain conditions one man might be entitled to ten dollars and another would only be entitled to ten cents. It was stated in the paper that corn, beef, and pork cost alike to each one. That is not true; we know perfectly well that the millionnaire buys more delicate goods and pays more for his beef, canned goods, and all articles of food than he who is earning but two dollars a day. He pays more for his cooks, and has his food better served than persons of moderate means. He may even pay ten thousand dollars a year for a cook, where most pay but a few dollars a week. There are many things which go to increase the cost of his food, so that there is a difference in the cost of even the simple things that go on his table.

Dr. Allen.—There is a principle at stake here which every one should recognize. I feel that each one should know for himself what his time and his services are worth, and that we should seek to enlighten our patient in this regard. As a rule, we are apt to gauge the value of our services by what we can get for the same. For instance, a young practitioner may not feel that his services

would bring as much as one who has been in practice for twenty years, or longer. It seemed to me that the simplest way of getting at the point is for each one to determine for himself what he is willing to work for,—the sum that a day's labor ought to yield,—and having determined that point, let us gauge our fees accordingly. I am perfectly willing to work upon that basis. I believe that we can work with much more justice to ourselves and to our patients if we make a definite charge for the time the service occupies, the cost of the material used should not be specially considered (except in artificial dentures) as it is very trifling compared with the fees charged.

Regarding charitable work, if I give an hour's service I give it in the name of charity. I do not ask or expect any one else to pay for the bestowal of my charity. I will work the remainder of the day, and apply the net proceeds to myself.

Dr. Clapp.—One remark of Dr. Allen's has great force in this connection, and that is, that each man must, so to speak, be a law unto himself. I do not believe that there is a business, a specialty, or a profession, or any occupation in the world that requires so much uprightness and force of character to stand on the top plane of possibility as the dental profession, and there is no man living, outside of the operator himself, who can properly say what his fee should be. There is no other man that knows the circumstances, and when we come to gauge and to determine the fees for dental operations by any fixed law, or by any analogy of reasoning, I do not believe it is possible to equitably do it. Some time ago I went to a physician to pay a bill, and at the same time that I was in his office I was troubled with a slight affection of the throat. He is one of our foremost practitioners here in the city, and I asked him to look at my throat. I stepped into the light and opened my mouth. He looked into my throat and said, "Humph!" then turned and wrote a prescription, and handed it to me. The whole thing did not exceed one minute and a half, and his fee was three dollars. Now, I did not pay him for the time he occupied in looking into my throat and writing the paper,—I paid him for his twenty-five years' experience. And, to my mind, he gave me greater service in that minute and a half than many another man would after studying my case an hour. The matter depends largely upon one's own personal experience and one's own conscientious application to the question of fees as well as to means and methods of work.

Dr. Grant.—I do not know that I can add anything to what has already been said. I am very much interested in Dr. Barker's

paper, and the thought occurred to me, which has already been so well stated by Dr. Allen and Dr. Clapp, that there cannot possibly be any other standard for fixing fees except the man's own judgment in the matter. He has of course many things to consider,—first, what his education has cost him; then the class of patients he can command, and also his years of active life. I do not know exactly how a man can fix the standard of his professional services, it depends a great deal upon his motive in entering the profession, whether to gain fortune, or simply for what is the ideal plan,—of doing the best he can for humanity and getting simple remuneration that shall give him comfortable life. Every laborer is worthy of his hire, but while many men put much time and comparatively small capital in cash into their profession, of course many others put both, and then there is the interest on time that he spends in perfecting himself and the interest on actual capital invested to be taken into consideration. Of course, the man who gives both time and money to his profession cannot afford to work on the same plane as the man who only gives his time. I think the principal element which is taken into consideration in adjusting fees is the class of patients that are attracted to a man either by his professional reputation or by his social standing. It seems impossible that there should be a general plane upon which all dental fees could be gauged, each one of us must do as our conscience and our foresight in the matter of temporal affairs shall dictate.

Dr. Williams.—Perhaps some of you may have heard of the curious way in which a dentist in one of the suburbs of Boston used to charge for his services. He charged according to the number of sheets of gold he put in a tooth, and, of course, the effect of it was for him to see how much gold he could pile on, and he used to make some very peculiar structures.

Dr. Brackett.—I do not think it is essential, because we perform a gratuitous operation for a patient who needs it, that we should charge for that operation some one who is more than able to pay. I think the remarks of Dr. Allen—"If it goes as charity it should really be charity"—are most commendable. In this particular, although we do a great deal for which we receive no compensation, it is little compared with what those of other professions, especially physicians, do; and it has been urged against our claims to professional standing that we have not done the amount of gratuitous service that men of broad cultivation and higher plane might well do for the advantage of humanity and the world.

Dr. Smith.—It may be unfortunate, from a purely scientific point of view, that fees have anything to do with our work. If we were all born of wealth, and could practise our calling merely for the love of it, we would not have this question to contend with; but with things as they are, it is a matter largely of supply and demand, and the fee must be limited to that demand. For instance, if a practitioner finds his time taken from early morning until night, with others begging him to work on the Sabbath, he can with justice say to himself, "My fees shall be a little more than they have been. There is a demand for my services by people who have the money and are willing to pay for them." I have had people say to me, "Dr. So-and-so charges fifteen dollars an hour for his services, don't you think he is a robber?" I would say, "Not at all; I suppose he is now obliged to refuse appointments with people who would pay him twenty dollars an hour if he could accommodate them." I think our fees must be limited almost entirely by the demand upon our professional services.

It has been said that the dental schools, the hospitals, and the infirmaries take away, in a measure, the opportunity for young practitioners to gain an income from their practice, which is very true; but it must not be understood that we are opposed to the hospitals and infirmaries. They should be conducted, however, in such a manner as to cater only to the strictly charitable patients. The demonstrator, I think, should have the power to make a distinction between those who can afford to pay and those who cannot, and when a woman goes to a dental school wearing diamond earrings, seal-skin sack, and eight-button gloves, it is time she went to some office and paid a fee.

With regard to charity work, it is much harder for us to do this work and not suffer more for it than any other profession. A medical practitioner can see a number of patients in a short time, many of the cases being evident to him at a glance, and requiring but a minute and a half of his time, as the one cited here to-night. What can a dentist do in a minute and a half that is charity? If he fills a tooth, it takes time; if he treats a tooth, it takes time; and if he tries to do much of this work, he finds he has used up a large share of his time, and his time is his stock in trade. A lawyer can give his advice and do charity work and his income does not feel it, and there are other professions which do not suffer financially from the charity work which they see fit to give. Physicians suffer largely from our hospitals and charitable institutions by the richer people taking advantage of them. I was told by a noted

surgeon that wealthy patients will go to the hospital and take a private room and have the services of the best surgeons, and it costs them nothing for the surgeon's services, they merely pay the rent of their room, the surgeon being obliged to give his services because of the position he holds. I understand that it is becoming a common practice for rich people to go to hospitals where they have the services of the physician and nurse free; perhaps they think they are better treated. The physicians have a sliding scale of prices; for instance, the fee charged by a noted oculist for the removal of a cataract for a very rich patient was five hundred dollars; for a patient in moderate circumstances his charge would be two hundred and fifty dollars; for a person in less than moderate circumstances, one hundred dollars, and even less than that, so in that case the rich pay for the poor. To a certain extent I think that is just. The oculist may put himself on this ground: that his fee for the removal of a cataract is five hundred dollars; every dollar which he discounts from that is to that extent charity work.

There is another point of which I wish to speak, and that is, that a fee should be charged for everything we do, unless we make it a charity case and charge nothing. It is quite common among dentists to make an examination of the teeth, which, if properly done, takes fully half an hour, and yet it is a common practice to make no charge for it, in the expectation that the patient will have to pay for it later on. I say that is unprofessional. I say that every operation—and an examination, I hold, is one of the most important of operations—should be charged for.

In regard to whether we should base our charge upon the minimum or maximum basis of time,—I don't think either is correct; it depends entirely upon the patient. For instance, if I am performing an operation for a very nervous patient, and it takes me two hours to do what I might do for another in an hour's time, I hold that patient should pay me just twice as much. I sympathize with the lady on account of her peculiarly nervous temperament and know that she is not to blame for it, yet I cannot afford to suffer financially for her misfortune.

Dr. Barker.—Of course, Mr. President, for me to say anything is only to say in a different way that which I have already said in the paper. But before I attempt to go over the ground which I attempted to cover in the paper, I want to say one word with reference to myself. There seems to be an idea prevalent that I am a socialist. I am not a socialist, nor am I a nationalist, prob-

ably no more so than most or any of you here. I simply believe in justice. I believe that one of the first principles which should govern any person after they have arrived at adult age is the principle that they are bound to take care of themselves. God gave us all a stomach which needs supplies of food, and with the stomach he gave us two hands to supply the needs of the stomach, and absolutely no one but ourselves ought to be expected to or be called upon to supply those needs, provided we have health and strength. And let me say incidentally that if conditions were as they should be, there would be an opportunity, at least, for every one to employ the hands for the satisfaction of the needs of the stomach, and we should not find a large class in this community—as we find in every community—not only supplying their own needs, but supplying the needs of a large class of drones, which we may liken to barnacles on a ship, aiding in no way its passage over the waves, but rather retarding its progress. Of course, this question resolves itself at bottom into a great moral question. Now, if you admit that when a man arrives at adult age he is bound to take care of himself, that he may not rightfully call upon anybody else to take care of him,—if then he is bound to supply his own needs, and may not rightfully be called upon to supply any but his own needs, will some one please tell me how we can fix on anything but cost as the limit of price which he is to give to his neighbor in exchange for something which the neighbor gives him. I admit that it is difficult to determine the absolute ideal in any given case, but let us suppose that it has cost me in time, effort, material, and repugnance to overcome something which Mr. Smith wants more than he wants the coat on his back. He has an extra coat, which he thinks will do him just as well. I like that coat, and a barter is arranged between Mr. Smith and myself. Suppose we make an exchange. If I am to get in that exchange a coat which cost him more than twenty, why I have been getting something for nothing, and manifestly, I have been making Smith contribute to my support, whereas I ought to support myself. We become perplexed in thinking over this question, simply because, under present conditions,—and these same conditions have existed for many centuries and are likely to exist for some time to come,—this principle has not been recognized. We all of us say if we get a hungry man who will pay us a good price, we will take it from him, and we practise it too. In spite of the illustration offered to-night to prove that the rich man pays more for his needs than the poor man, it is not a fact. The grocery where I trade is patronized by

men of all classes, and the wealthy men do not pay a penny more for the sugar, the flour, or the beef they use than any of the others. And they ought not to. What right has the grocer, the dentist, or the doctor to say what the ability of the purchaser is? What right have I to say to the seeker of my services that he shall pay a fee proportionate to his ability to pay? It is none of my business, gentlemen, what the ability of the purchaser is, it is none of your business. You may estimate the cost of your services, and the would-be purchaser, if he is a wise man, will place his own estimate upon their value to him, and if the cost seems to him to be greater than the value, he will not purchase. And now, because we have a class in every community who have amassed colossal fortunes, and are rich beyond the dreams of avarice, because they have ignored this cost principle, and they fall into your hands, you say you will recover your loss by getting all you can from them. Because he has been a great bandit, you will be a lesser bandit, and think it is all right to take from him a part of that which he has taken from others. The ideal thing is for every man to take care of himself, to live upon the rewards of his own industry, keeping his hands entirely off of that which his own industry did not produce. But, some one will say, am I to starve? And, as I said in my paper, a man who should undertake to do business upon ideally equitable terms where no obligation to reciprocity was recognized manifestly would have to go to the wall, and when you come to look at this question closely it resolves itself down to this: How far may I violate a correct principle in order to maintain my life? As I told you in my paper, conservation of energies is essential. Believing that I have no right to take from a patient in fee one penny more than the service has cost me, I may rightfully, however, include in the reckoning the cost of material and time expended directly in it, and a proportionate part of the time, thought, and study expended in my preparatory student days, and something for repugnance overcome, until finally, as I said before, it comes down to a question of casuistry,—How far am I willing to conform to a principle which seems correct? One of the great troubles comes in the belief or conception which most people have, that they ought, during the years of their active life to accumulate wealth enough to erect a barrier between themselves and that contingency, which none of us like to contemplate, namely, the poorhouse, and so they say, if I can find a rich man here and another one there, I will plunder them by the ordinary means, and I will use my plunder to erect this wall or barrier. My object in this

paper is simply to point out a principle, leaving each man himself to be the judge as to how he shall apply it in his own practice. We sometimes hear that a certain dentist gets twenty dollars an hour for his services. Did you ever really think what it meant? The majority of people, right here in the city of Boston, working for a living, cannot command on an average more than two dollars a day for their labor, and yet some dentist, because he has spent some time and money in educating himself, thinks he has a right to appropriate in one hour what that man would earn in ten days. I simply say that such a fee as that violates the reasonable correspondence between cost and price. I do not undertake to say just where the line lies, no man can say that. I have an item in my note-book, clipped from a paper, which says that a dentist in New York took five hundred dollars in one fee for a service which occupied but ten hours of his time. What items of cost were there included to make his services worth fifty dollars an hour? I thought at the time I first saw it that it was infernal robbery, and I think so still, and I believe that any man who is willing to support himself and wants to come honestly by everything that he gets cannot charge any such fees.

Some half a dozen of you have summed it up, now let me sum it up. You seem to think when you are disposing of your services to men of varying means, some of them millionnaires and some of them poor men, that you have a right to take what they can afford to or can be made to give you. Let us place ourselves in the position of the buyer who needs our services, and who says, rather than go without them, he will pay five hundred dollars, and we can perhaps better see the injustice of making one's ability to pay, or the value of the service, a measure of its price. Our steam- and horse-railroads, our theatres and our merchants, from an A. T. Stewart to the peanut-vender under the shadow of his war-horse, have the same price for a like service to rich and poor alike, and there is no principle which can govern any other course. To get what you can is not principle. It is something suggestive of cannibalism.

In disposing of our services let us ask, What has it cost me? and keep out of sight, so far as possible, the question, How much can he afford to pay, or be made to pay? Self-preservation and the continuance of civilized institutions will sooner or later force society to adopt some such principle as we have presented. In the mean time let each man hew as near the line as, under all the circumstances of his environment, he can, and all the sooner shall the drones be driven from the hive, all the sooner shall labor and in-

dustry have its full reward, and idleness and inefficiency likewise receive their rewards, and so civilization will be perfected.

Subject passed.

Dr. Fillebrown.—I have here a record of twenty-two consecutive cases in which I have used the dental thermo-obtunder. If there are any members here who have not seen this instrument, I will say that it is a little cylinder which holds a small cartridge. The cartridge contains a wick which is saturated with alcohol. Beyond the cartridge is a copper bulb which is heated, and beyond that is a tube which carries a small spray of alcohol vapor into the tooth. The temperature conveyed by the alcohol vapor is about 110° F., and it usually takes about sixty seconds to obtund the tooth.

Eighteen of my cases the patients pronounced completely successful. Four cases were only partially successful, but the operations were made more endurable by the use of the obtunder. Of the four cases, two were much benefited, but suffered considerably in the application of the remedy. One case suffered much in the application, though it was made gradually, and seemed to get no benefit at all.

Dr. Andrews.—I have had one of these appliances for a week, and have had no occasion to use it.

Dr. Ainsworth.—It is remarkable, when a person has the instrument, how seldom he will require to use it.

Dr. Allen.—I suppose many of you know I have used that instrument almost from its first inception. Mr. Small brought a very crude form of it to me shortly after he brought it to the notice of the profession, and I used it with excellent results. He subsequently furnished me with a smaller instrument, which does the work equally well and can be more easily handled. I do not have occasion to use it every day, but I have been very successful with it, and I have yet to see the first case where permanent injury has been done by it.

Dr. Fillebrown.—Sometimes, it seems, the presence of an instrument prevents the need of it, but we also find that there are many times when we can use it effectively. I did not say that these cases came right along consecutively, or that I need it in every operation, but I have taken the cases as they occurred, omitting none, and brought them all together. So far as I have gotten in the matter, it seems to be a very desirable thing to have. The success of this, as other instruments, depends upon the faith and skill with which an operator uses it, and the determination he may have to thoroughly understand it.

Dr. Ainsworth.—Perhaps I have not put myself clearly before the society in this matter. I believe in the instrument and believe it will accomplish a great deal. I have for a long time, as many of the rest of you probably have, used alcohol in various ways, both hot and cold, but this instrument seems very much superior to anything that I have seen or thought of. I consider it a valuable acquisition.

Dr. Barker.—Our President, Dr. Seabury, requested me to bring some aluminum foil to the Academy this evening, and such of you as wish can take some of it and experiment with it. It has been recommended as a filling-material, but he says that he thinks this particular make is too fine for practical purposes, but perhaps a little heavier make than this might be used with advantage.

The regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms on May 6, 1891, President Seabury in the chair.

The paper for the evening was read by A. K. Stone, M.D. Subject, "Dental Responsibillty for Early Diagnosis of Tumors of the Mouth and Jaws."

DENTAL RESPONSIBILITY FOR EARLY DIAGNOSIS OF TUMORS OF THE MOUTH AND JAWS.

BY ARTHUR K. STONE, A.M., M.D.

When your president asked me to write a paper for your Academy on tumors of the jaw I supposed that I had a fairly easy task before me. But after spending some time in looking over the literature of the subject I came to the conclusion that to write an article which should be of any practical value would in reality be a very difficult task. Therefore I feel that I must ask your indulgence and good nature for the shortcomings of this paper.

The first thing that strikes one who is making a study of this subject is the fact that its literature is filled with reports of mammoth tumors, unique specimens, and rare cases. These are dwelt on at great length and pictured in all their horrors, and the idea is given to the student that the terrible tumors are of frequent occurrence, while, in reality, this is not a just conclusion, for upon careful investigation of the reported cases and the articles in the "Systems of Surgery," both general and dental, the fact is developed that the pictures and the cases are repeated time and time again. In fact, many of the cases have, so to speak, become the stock in trade of writers on tumors of the jaw. And with these they have covered up the important, common, every-day facts, so that they can hardly be found. Even Sir Christopher Heath, in his most recent article, bases his arguments upon specimens which have been in the museums since 1834 and 1847.

It is obvious to you all that such giant tumors can have no real interest to you as dentists, or, in fact, to practitioners in general. They are interesting to us as rarities; and they are interesting to the hospital surgeon who may have them to remove, provided, of course, that he is anxious for that sort of an operation; and you and I should be pleased to see the operation, but we should

feel thankful that we did not have the responsibility on our shoulders.

These large tumors are the interesting tumors, so called, but fortunately they are extremely rare. That these new growths monopolize to such an extent the literature of the subject is but a fair example of much of the medical teaching. We are taught the uncommon and rare things with the same or even more emphasis than we are taught the things of every-day occurrence. In fact, the young man in medicine has to spend a good part of his first years in practice in forgetting the freaks and learning to recognize the common, no matter under what guise it may appear. I hope that the dental teaching is much wiser in this respect.

New growths of the mouth and jaws, though common, medically speaking, are really rare. But the importance of their early observation and consequent accurate diagnosis cannot be overrated. And it is in the power of this society to do much to make severe deforming jaw operations largely unnecessary. By this I mean that in continually searching the mouths of your patients you have the best opportunity to discover new growths in their earliest stages, make an accurate diagnosis, and carry out proper treatment before the disease, if it is malignant, has gone so far that only a severe operation will suffice. Not only can you do this, but the responsibility of not doing it must rest upon you. If you will consider all tumors and ulcers about the mouth and jaws serious until an absolute diagnosis has been made, much of the terror of malignant disease of the jaw will be lost.

To accomplish this desired result, it is necessary to know—

1. What new growths are liable to be found on the lips, jaws, and tongue.

2. What the growth under consideration is.

3. The appropriate treatment.

The first requisition can come only from familiarity with the subject in the various text-books and a study of reported cases. Second, diagnosis in doubtful cases, thanks to cocaine, can often be absolutely settled by the pathologist; while the appropriate treatment must frequently be left to the surgeon, who may need all the resources of a well-equipped hospital to enable him to treat the case in a proper manner.

A most common form of tumor of the jaw is a simple inflammatory condition due to irritation occurring about an unremoved fang of a tooth. With this as a starting-place, the pus can soon infiltrate the tissues, causing partial immobility of the jaws, on

account of the large, boggy swelling of the surrounding parts, foul breath, and a general malignant appearance. Such cases are specially for the dentist to diagnose. The surgeon is apt to think too strongly of malignant tumors, and, not being so skilful in working in the small space afforded by the nearly closed jaws, easily misses the offending root and demands a radical operation. Besides, his unfavorable prognosis will unnecessarily frighten his patient. Care and patient investigation will reveal the old fang or bit of dead bone, and, when these offending causes are once removed, antiseptic applications and cleansing mouth-washes will usually quickly return the jaw to its normal state.

The ulcers of the jaws and tongue next deserve mention. They are of special importance, as in their early stages accurate diagnoses are impossible. Ulcers of the lips do not come within the scope of this paper, though it may be well to state that a really common form of ulceration of the lips—*i.e.*, cancer of the lower lip—can, by its secondary deposits, involve the jaw. But early recognition of the disease, and operation, will probably prevent this disastrous result. The operation is comparatively simple and *can* be done with cocaine.

Ulcerations in the mouth may be simple inflammatory conditions, due to the irritation caused by the sharp edge of a decayed tooth upon the tongue, cheek, or gum, or may start from wounds of the mucous membrane, caused by toothpicks or other like things held in the mouth. Sometimes the ulcerations are due to syphilis or tuberculosis, or, it may be, to malignant disease. All these ulcerations have the same general appearance at the beginning, and it is only after careful observation that one can say that a given lesion is cancer, syphilis, tuberculosis, or a simple ulcer. In order to make the diagnosis, the position of the ulcer must be thought of. If it is where irritation from the sharp edge of a tooth or a mass of tartar can occur, the exciting cause must be removed at once and simple measures adopted to heal the ulcer. This will usually succeed, and in a few days the ulcer will disappear. But if it does not, valuable time must not be lost by making fruitless efforts to check a malignant disease. Under cocaine the surface can be scraped, or a part, a mere scrap, removed, and proper examination will probably show whether the sore is tuberculosis or cancerous.

The position of the ulcer, if it is on the tongue, may give a hint as to the diagnosis. Syphilitic gummata almost always occur on central portions of the tongue, while the cancerous and tubercular are usually on the side.

All ulcerations may have indurated bases, but epithelioma more frequently presents a hard indurated mass lying beneath the ulcer than any of the other forms. And the same is true of the neighboring lymphatic glands; they are more frequently enlarged in cancer than in the other lesions.

Mucous patches rarely occasion any great amount of trouble in diagnosis, so I will do nothing more than mention them.

In passing, it may be well to state that a man, or a woman either, can have a chancre on the lip or tongue; it is commonly near the tip of the tongue, and the induration and enlarged glands are as a general thing well marked. Try for a history, and that will settle the diagnosis. A quiet dinner, with some champagne, etc., followed by a little trip in the town, two or three nights before the appearance of the ulcer, will be pretty conclusive evidence as to the nature of the disease.

A common form of tumor seen in the mouth is the ranula. This is a cyst of one of the ducts through which the saliva of the submaxillary or the sublingual glands is conveyed to the mouth. It is caused by a stoppage in either the ducts of Wharton or of Rivini. By the plugging of these ducts the saliva is dammed back, the duct is distended, and the cyst formed. Bryant states that this is not the fact, but that the cyst is always in the mucin glands in the floor of the mouth. Examination of the reported cases shows that the so-called ranula may come from any of the above-mentioned causes. The diagnosis is easy, as the tumor is evidently cystic in character with clear, fluid contents, and careful examination will show that it is located entirely on one side of the frænum of the tongue. If there be any doubt as to the diagnosis, an exploring needle will show the contents to be clear, glairy fluid, either mucin or saliva. Sometimes simple evacuation of the contents is all that is necessary to effect a complete cure. At other times a piece must be cut out of the cyst-wall and the interior packed with gauze in order to allow it to granulate. Before passing on, it may be well to remark that a salivary calculus may be the cause of the stoppage in the duct. In such a case the presence of the stone must be determined and its removal secured before a cure can be effected.

Cysts of the jaws may be divided into three classes:

1. Simple cysts, with simply watery contents.
2. Dentigerous cysts, which in addition contain a tooth.
3. Multilocular cysts, or, as they are sometimes called, cysto-sarcomata or cysto-adenomata.

The first two varieties are benign in their growth, while the third may be either benign or malignant.

Simple cysts may spring from beneath the periosteum, and, if situated in the lower jaw, bulge the inner part of the alveolus so that they appear more prominently in the mouth than externally.

The other variety of simple cyst has its origin during the embryonic period of the tooth-follicles before the formation of the dentine and enamel. Their growth is usually slow and painless. If they attain any size so that the bone over the cyst-wall is sufficiently thinned, pressure over the tumor will give the so-called egg-shell crackle. The contents, as already mentioned, are clear and watery.

The dentigerous cysts are those which in addition to the fluid contents also contain a tooth, or the remains of a tooth, commonly one of the permanent set of teeth, though it must be borne in mind that an adventitious tooth may be the exciting cause. The crown of this misplaced tooth is usually perfect, while the roots are for the most part absorbed. To establish a diagnosis the absence of some one of the teeth is to be considered; if the bone is thin enough the crackle will be present. While the exploring needle, especially in the hand of the dentist who is skilled to distinguish between bone and enamel, will in many cases disclose the presence of the tooth at the bottom of the tumor, and the escaping fluid will show the cystic character of the growth.

The above-described cystic tumors are generally slow of growth and give but little pain. Where there is little or no deformity there is no reason for urging the removal of the tumor, as there is no danger of its ever assuming a malignant character. And, furthermore, though it may be growing comparatively rapidly for the time being, it may cease before it assumes unpleasant proportions and never give further trouble.

It must be remembered that the strange position of the growth must not make you hesitate in making a diagnosis, providing that other things point to the cystic character of the tumor. There is, for example, among the strange cases on record, one where a cystic tumor caused by an almost perfect canine tooth was found on the palatine vault.

Operation upon the cysts of the jaw consists in cutting away part of the wall of the tumor, the removal of the tooth at the bottom of the cyst if it is present, and then packing the whole cavity with gauze and allowing the cavity to fill with granulations.

The multilocular cystic tumors are of a rather different nature. They occur almost always in middle or advanced life. In younger subjects they are apt to be slow-growing, without manifesting any special tendency to spread and involve the neighboring parts; yet as the patient becomes older the tendency to malignancy is much greater. And when the growth is removed, unless great care is taken to include all the parts involved, the tumor is practically sure to return. The multilocular cyst is more frequently found in the lower than in the upper jaw. It starts as a small swelling near the socket of the tooth and slowly increases in size. Sometimes it attains large dimensions. The tumor grows within the substance of the bone, gradually expanding the compact wall, which forms a more or less complete capsule. The size of the various cysts varies from an extremely small, honey-combed condition to those which are a half-inch in diameter, or even larger. The septa between the cysts are generally ossified.

The contents of the cysts vary even in the same tumor, in some cases being clear and limpid, while in others almost gelatinous and of a dark-brown color, due to presence of blood-pigment. The histological examination shows a marked resemblance between the tumor and the enamel organ. In the tumor the alveolar walls are covered with a columnar epithelium resembling the inner layer of cells of the enamel organ. And these cells enclose a gelatinous tissue which preserves traces of a net-work of stellate cells which is comparable to the gelatinous tissue in the centre of the enamel organ. On the other hand, there are several cases where the tumor was evidently the result of an ingrowth of the epithelium of the gums. When the tumor has attained large size, some parts fluctuate and some parts crackle, while the general feel is rounded and lobulated. If the disease is located in the upper jaw it is hard to diagnose from solid tumors of the antrum, unless the cysts are unusually large. The rate of growth is very slow, and there is but little tendency to invade the surrounding parts or glands, and still more rarely do they invade the whole system. Yet when appearing late in life these tumors may manifest a marked tendency to extreme malignancy.

Under the general term epulis is understood those tumors which spring from the periosteum of the alveolus. These tumors may be either simple fibromata or sarcomata, or, very rarely, epitheliomata. Epulis means simply "on the gums;" but the growth always starts from the periosteum,—usually from the periosteum about a decayed or decaying fang. The disease is commonly seen in young adult

life. The tumors may grow to large size and give much trouble from their mechanical pressure and obstruction alone. But such cases, though once apparently common, are now rare, as an early operation is as a general thing the rule and not the exception. Epulis usually makes its appearance between two teeth, looking at first much like a bit of hypertrophied gum-tissue. But before it attracts notice it has commonly passed this stage, and it is quite plainly a new growth when the patient presents himself for consultation. If the tumor is a simple fibroid it is apt to be quite tough, while if it is a sarcoma it will be probably soft and vascular. As it grows larger the teeth are separated, and there may be some neuralgic pain, though on the whole the tumor is painless in its growth.

Should the attending physician simply content himself with a removal of the growth, he will find that its return will be only a matter of a few weeks. Something more radical is demanded; how much, depends on the diagnosis. Here is a most favorable chance to make a differential diagnosis. By the use of a little cocaine, and a one-per-cent. solution is all that is required to accomplish the desired result, a piece of the tumor can be secured and sent to the pathologist, or a fresh section can be made with a good sharp razor. Examination with a low power of the microscope will probably settle the matter, as the difference between a large-celled sarcomatous tissue and a fibromata is well marked. On the result of the diagnosis depends the operation to be recommended. One or two teeth must be sacrificed at all events. But if the new growth is a fibroma, and not large, thorough scraping of the periosteal surface from which the tumor springs will usually suffice to prevent its recurrence. If, on the other hand, the tumor is a sarcoma, a goodly piece of the alveolus must come away in order to get beyond the disease. In case the very rare form of cancerous epulis should appear, a guarded prognosis must be given as to the absolute success of the operation. And at the time of the operation a much larger piece of the alveolus has to be removed, and if there is the least suspicion that the disease has invaded the jawbone itself, there should not be the least hesitation on the part of the operator to do a much more serious operation.

The sarcomata in general differ in their malignancy according to their cell-formation. Some have a tendency to rapidly invade the neighboring bone and tissues, while others grow slowly and are almost benign in their nature. At times they are characterized by the formation of bone and cartilage in their substance, and are then

known as osteo—or chondio—sarcomata. But such fine points are of special interest to the pathologist and to the surgeon after the tumor has been removed, as thereby he is able to make a more accurate prognosis.

New growths of the antrum present so many difficulties in diagnosis and operation as to deserve a much more extended treatment than I could give in this paper, therefore I will not speak of them at all.

I have endeavored in the preceding pages simply to suggest and indicate to you the most common varieties of tumors which you may at any time run across in your practices. But as a class, tumors of the jaw are fortunately rare, and no man can expect to see enough of them to make him absolutely sure of his ground in all cases. But every one should know enough to see when it is necessary for him to shift the responsibility of any given case from his shoulders to that of a surgeon, who has all the equipment for the most severe operation which the necessity of the case may demand.

DISCUSSION.

Dr. Fillebrown.—Mr. President, I desire to thank Dr. Stone for the very intelligent, instructive, and exhaustive paper which he has favored us with. I feel consoled by what the doctor says about the paucity of cases which present themselves. Such cases have always been of interest to me; in a sense I have been looking out for them. I thought that perhaps I had found many less than I ought to have found. It seems, however, that I have at least had my share. To add to the interest of this occasion, I have selected three cases and will present them for your consideration to-night.

CASE I.—Miss ——, aged thirty-five. Odontocele in left superior cuspid region. The patient was brought to me by her father, a physician, who had extracted her upper teeth preparatory to a set of artificial teeth. Tumefaction of the left side remained, and in regard to these conditions he desired my advice.

Upon examination with a steel probe I felt what was evidently enamel deeply embedded in the tissues. An operation revealed a fully-developed cuspid tooth lying almost horizontally in the jaw, the crown pointing forward. The removal of the tooth was followed by immediate recovery, and the mouth was soon in perfect condition for a plate.

Such a case must come to very many of us, and the only peculiarity about it was that it showed the value of special judgment as

perfected by special practice. The gentleman who brought the patient (and she was his daughter) was a man of large medical knowledge and of considerable surgical ability, and yet he combated my position very strongly and would not admit even to the very last that there was a tooth in the mouth. He was sure that they had all been removed.

I remember another case which illustrates a tumor of the crackling egg-shell quality as described by Dr. Stone. I never quite understood the cause of it. The patient was a young man, and the only abnormal appearance about his mouth was the fact that the six upper teeth, involving the region from one cuspid to another, were a good deal crowded. There was considerable tumefaction there, and upon pressure over the tumor a crackling sound could be heard and a crackling sensation felt. The tumor would yield to pressure, and upon removal of the finger a depression remained for a time, but the original shape was regained. The patient's teeth were so crowded and irregular that he desired them out, and as this seemed best in his condition, I removed them. There was no discharge from the tumor and nothing unusual occurred. The tumor got well in a short time after the removal of the teeth. Whether the crowded teeth could have caused that condition, I do not know. A probe passed up through the socket of one of the extracted central incisors showed quite a large cavity which remained open for a good while, but finally was completely cured without further treatment. As soon as advisable the patient had artificial teeth, and as far as I know has had no further treatment.

Case II.—Mrs. ——, aged forty-five. Epulis arising from the pericementum of the left inferior second bicuspid mesial surface. Cured without operation.

This tumor had existed for some time, and when my advice was asked it filled the space between the bicuspids and protruded considerably into the mouth. Applications at various times had failed to destroy it or much restrict its growth. The patient was very nervous, and would not consent to anæsthesia or to any operation without it. I concluded to try constant pressure with styptics. I selected the persulphate of iron, and taking a pellet of cotton of suitable size to fill the space between the teeth, I coated it with the powder and packed it down upon the tumor. This was repeated at intervals of one or two days for about two weeks, the cotton being packed directly upon the tumor. The bulk of the growth disappeared upon the second application. Then, by following carefully to the starting-point of the tumor, I succeeded in

effecting a complete cure in the two weeks, and without any operation involving the cutting of soft tissues or removal of bone.

CASE III.—Mr. ——, aged thirty-five. Tumor of upper jaw with suppuration. In February, 1889, this patient came to the Harvard Dental Hospital, accompanied by his physician. He showed himself to be intellectually bright and capable. His stature was diminutive, he being less than four and one-half feet tall. The upper frontal portion of his skull was well developed, but the superciliary ridge was very receding, not projecting at all beyond his eyelids, and the whole surface of the skull was very irregular.

The calcareous elements were quite largely in excess in his bones, in consequence of which his limbs had been broken some six times by slight causes. His muscular system was very well developed. His upper jaw was very small, much smaller in proportion than the under, the latter being quite prominent. This patient showed an extremely long, soft palate, the uvula and opening to the posterior nares being quite as low as the normal position of the glottis. On the whole, his mouth exhibited a unique appearance. His upper jaw presented some very large and long teeth, much swelling of the soft tissues, with copious suppuration. The teeth were loose, and the cuspids and bicuspids seemed to move together.

His case had been diagnosed as necrosis, but as there was entire absence of the characteristic discharge, and to my touch the teeth moved independently of the jaws, I came to the conclusion that the condition was abscess caused by the teeth, and that removal of them would effect a cure. The evident ankylosis of the teeth, the enlargement immediately behind and connected with the bicuspid, and the excessive size of the apex of the roots as shown by the probe left no doubt in my mind that we had to deal with an odontocele.

I was quite unable to convince the patient's medical adviser of the correctness of my diagnosis before the operation, hence I was obliged to await the result. There was no question as to the necessity or propriety of operating for him, as, whatever the condition, operation was the only way to obtain relief.

The patient was anæsthetized with nitrous oxide. Ether was immediately added and ether narcosis induced. An incision was made along the necks of the teeth extending as far as the boundaries of the tumors, and the teeth seized with forceps and the several bodies removed. These I show in this connection. The odontoma of the left side is an irregular mass, one and one-fourth inches long by three-fourths of an inch in thickness, consisting of a cuspid, first bicuspid, and an aborted second bicuspid and molar.

The crown of the cuspid and first bicuspid are normal in form and development. The root of the cuspid is enormously developed, it being seven-eighths of an inch long, the portion near the apex one-half of an inch in diameter, and much curved backward. The root of the first bicuspid is also very large, and the surfaces of both are very irregular and rough from hypercementosis. The second bicuspid and molar are entirely rudimentary, a section showing the irregular formation of secondary dentine, with no pulp cavity remaining and hardly a trace of a formerly-existing one. The cuspid was separated from the rest of the tumor, and with no sign of pericementum. The other three teeth were fused into a single mass, and were nearly covered with what seems to be serumal calculus.

The tumor from the left side consists of three teeth,—cuspid, bicuspid, and molar,—and is very similar to the other. The cuspid and bicuspid crowns are normally developed, the cuspid root very long and large, and the root of the bicuspid also very large, and both very irregular. The molar is a little more regular in form than the one on the left, with quite a large pulp chamber with a branch corresponding to a root canal, the whole forming one connected mass and covered with calculus. Attached to the right bicuspid is a portion of the alveolar wall united with it by complete ankylosis. There is also a small portion of bone attached to the left cuspid. There is no sign of necrosis on either of the tumors. The patient made a good recovery.

In March, 1891, the same patient returned to the hospital with a chronic abscess discharging under his chin on a line with the bicuspid teeth, and nearly in the median plane, which had failed to yield to continued treatment. The location of the fistula had misled all who had observed it, consequently he had suffered from it for a considerable time, and he now came to see if his teeth had anything to do with it. He supposed that all his teeth had been removed. Upon probing I found roots present which were evidently causing the abscessed condition.

He was again anæsthetized with nitrous oxide. I attempted to remove the roots under the gas, but this was not readily accomplished, the brief narcosis not being sufficient. Ether was administered, and the roots removed. The left root proved to be a bicuspid with very excessive hypercementosis and with calcareous deposits; the right, an unusually large cuspid root. The specimens you see with the others.

In the two years since the first operation, his upper jaw has

become absorbed until his mouth is about the size of that of a child five or six years old. It would measure less than one inch from one molar ridge to another. It was a surprise to every observer.

The patient has not reported since the last operation, but I feel there is no doubt of his complete recovery.

Dr. Clapp.—I have been very much interested in the paper of Dr. Stone, and also in the remarks of Dr. Fillebrown, and I am very glad that Dr. Stone has emphasized the fact that these tumors he speaks of occur so rarely. Now, I have entered on my twenty-first consecutive year of practice in Boston, during which time I have probably seen at least an average number of patients with other practitioners, and during this whole time I have never seen a single example of either of the classes of tumors that has been mentioned. I might say further, in reference to the liability of cancers occurring from ragged roots or ragged teeth in the mouth causing irritation, I did have a patient many years ago who had a tooth of this kind. There was at that time a slight irritation that had been caused by the rough edge of the tooth, and I advised its extraction. I never saw the case again, but I learned some time afterwards that the patient died from cancer of the tongue caused by that tooth.

Dr. Codman.—I cannot say much on this subject. I have been looking for such tumors all these years and have seen very few, only one or two in all my practice, and those not important enough to fix in my mind, and yet I do not believe I have overlooked them. I think that we are not liable to meet with tumors of the jaw outside of the hospitals, except such small ones as can hardly be called tumors. It is important that some person should take up the subject as a specialty because the average dentist sees so few cases, and certainly if I had a patient with anything of that sort I would refer him to a specialist rather than perform an operation myself. I have read volumes on the subject, seen hundreds of plates, and yet have never been acquainted with an important case. I don't remember seeing one that I could bring forward at this time to interest the society.

Dr. Preston.—I don't know that I can say much about tumors, unless that term includes what are usually called "gum-boils," and I don't see that any one gives a cure for them. I have had three cases of that kind situated in the roof of the mouth. They were thick and sometimes as large as the ball of your thumb, and in my practice of over fifty-two years I have only met with three

cases. I have never heard of a cure for them; they generally dry up and disappear themselves, and all that I can say is, remove the cause, which is generally a dead tooth, and the swelling will disappear.

Dr. Smith.—Of course the case which Dr. Preston speaks of must be alveolar abcess, induced, as he says, by a dead tooth, and I think the majority of practitioners are curing such cases now without removing the tooth. The track is always there, and the seat of the abscess can be reached without extracting the tooth.

I will relate a case in practice of a tumor that was not a tumor. It was a case of severe swelling on the left side of the face low down in the jaw. The patient went to a surgeon who is on the staff of one of the hospitals here in Boston for treatment. He examined her carefully in his office and pronounced it a tumor, and advised her to go to the hospital at once and have it removed. Not satisfied with that, and being naturally fearful of undergoing an operation, she consulted another surgeon. He was not quite so positive in his diagnosis of the case, yet he also thought it was a tumor, and said that she had better go to the hospital and prepare for an operation. She finally came to my office, and the condition of the face when I saw it was the same as when she visited these two surgeons. The swelling was very hard, and she could hardly open her mouth,—not enough to admit a mouth-mirror,—so the examination was conducted under difficulties. I found that a tooth had been extracted on the affected side, and on futher examination I decided that the fang of a wisdom tooth was still there. Pressure revealed no soreness either within or without the face. A fine probe was introduced and it passed down indefinitely, so to speak, and I came to the conclusion that the trouble was produced by this wisdom tooth. I advised its extraction, which was consented to, and with the aid of antiseptic washes and applications to the outside of the face that so-called tumor disappeared. I mention this merely to show how, as Dr. Stone says in his paper, a physician could be mistaken in his diagnosis and call a swelling a tumor, when the trouble proceeded from a tooth. It is in such cases that the services of a dentist might frequently be of great service.

Dr. Taft.—I had recently a case in practice so analogous to that of Dr. Smith's that I will merely mention it. The patient presented herself one day with a very large swelling on the gum directly over the root of the left superior canine. It was then much smaller than it had previously been, but when she came to me her whole lip was

so swollen that her face was much disfigured. The swelling was very hard, with no fluctuation. Not being sure just what the trouble was, I thought best to consult a physician. It seemed to me that it could not come directly from the canine root, it was so small, but of course I had it in mind to remove the root sooner or later. The physician who consulted with me pronounced the case a cyst, as I had thought it probably was. After an application of cocaine, the cyst was lanced, and a very thin and copious watery discharge came from it. The patient was given gas and the root removed, and the swelling subsequently disappeared. It seems to me that that case was not really a tumor, but a simple cyst. Having so few of these cases in practice, a correct diagnosis is often difficult unless we keep ourselves well informed in dental pathology. Cases of epulis are the ones which we are most likely to meet with in practice, and I recall, as a student, how difficult it was to distinguish them from a simple hypertrophied gum. I feel quite interested in the subject of epulis, although since leaving the Harvard Dental School not a single case has come to my practice. I remember seeing at the Infirmary many operations for their removal, and call to mind how vascular some of them were. I am quite interested to know whether they can be removed successfully by a simple cutting away to the alveolus and a thorough scraping of the process.

Dr. Fillebrown.—Mistaken judgment seems to be one of the subjects that has come up here, and it is always very easy for us to see other people's mistakes and overlook our own. I have no doubt that I make my share of them and that other people see them and criticise them. I have three cases in my mind that illustrate mistaken judgment. Some years ago a patient of mine was taken ill and had a swollen face, and went to a physician who treated him for erysipelas of the face, gave him a good long treatment, and brought him through to a splendid cure. Soon after this the patient came to me with a fistula on the gum in the region of the apex of the cuspid tooth. He had suffered from an alveolar abscess. The other two cases illustrate mistakes arising from over-confidence in specialists. One of them presented a large swelling in the cheek which a physician pronounced an alveolar abscess. A short examination proved to me that the swelling was not attached to the jaw, and I said to the patient, "This is simply an abscess in the soft tissues, and if you will continue poulticing it you will soon find relief." In speaking of this case later to a surgical friend, I explained why I considered it an abscess in the soft tissues and not

an alveolar abscess,—namely, because it was entirely free from the jaw. Some years afterwards my surgical friend was called upon to treat a man who had a swelling in the right inferior jaw. He passed his finger in, and decided that the swelling was not connected with the jaw, and told the patient that it was a tumor and ought to be taken out at once. A few days later the patient came to me, and I saw that without a doubt his trouble was an alveolar abscess due to a first inferior molar, and it was as markedly connected by a fistulous canal with that molar as in any case I ever saw. The surgeon is surely as bright as any in New England and yet he was in error. After a little treatment in connection with the tooth the tumor got well.

A good illustration of epulis presented itself at the dental hospital the other day. The patient came for the extraction of teeth, and after they had been removed there was to be seen floating about in the mouth an epulis fully as large as the end of my thumb, and attached to the jaw by a little slender cord not one-sixteenth of an inch in diameter, but quite long.

Dr. Eames.—It is quite easy to pronounce a swelling in the jaw a tumor, but not so easy to classify it. There is a good deal of confusion with regard to epulis. I should like to know whether the cases spoken of here to-night were submitted to a microscopical examination; if not, I should reserve my judgment with regard to two of them. The term epulis indicates nothing as to the nature of the growth, and it would seem better to drop the name altogether and adopt some term which would indicate in a degree the origin and structure of the growth. The treatment should vary in accordance with our conception of the disease. If it is a tumor originating in the periosteum or endosteum of the alveolar process, then the alveolar process and a considerable portion of the jaw should be removed. I agree with Dr. Taft as to the difficulty of diagnosis. Quite a large growth may come from the irritation of a deposit of tartar. Three years ago I treated such a case by simple excision, and there has been no return up to the present time. On finding a swelling, we as dentists should first look for a foreign body or irritating cause, and attempt its removal. If there is not a rapid cure following local treatment, we should submit the growth to the microscope as suggested by Dr. Stone in his paper. Thus the case can be diagnosed more clearly and treated more intelligently.

Dr. Stone.—I don't know that I have anything to add to what I have already said, but the point that tumors of the jaw are rare

I think will be borne out by surgeons as well as by members of your society. I have under observation rather an interesting case of an apparently healthy young woman between twenty-five and thirty years of age, who some time ago was attacked with a severe pain about the position of the mental foramen, a very severe neuralgic pain that had to be controlled for the time being with morphia. When I saw her later the pain had disappeared, but there was no feeling in the teeth on one side as far as the centre of the jaw, and there was no feeling in the lip and skin outside. Upon the jawbone, not in the alveolus, was a swelling about the size of a walnut; it was evidently a new growth inside the jawbone which had pressed upon the nerve and caused the pain, and finally the destruction of the nerve and consequent paralysis. The nomenclature of tumors has been changing so rapidly in the last years that it is difficult to agree upon a precise meaning for a given term. The word "tumor" is a general name, meaning swelling, and "epulis" means a new growth from the gums. The diagnosis and consequent operative procedure will have to be governed by what the pathologist may decide in a given case.

Subject passed.

Dr. George T. Baker.—I have here a simple device which I use to insert a tooth temporarily in the mouth in case one has been extracted. It is only the work of a few minutes. It consists of a yoke of thin platinum wire, the two arms of which bend over the teeth adjoining the space to be filled. A plate tooth is ground to fit the gum and rest upon the yoke. The tooth is backed with platinum and soldered, and finally tied in place with floss silk. When properly tied it is very firm and serviceable.

Dr. Fillebrown.—Here is a piece of jawbone brought to me by a patient, and taken from the Florida mounds. Some of the teeth have been broken off, but two of them are whole. The broken ones show a perfect quality. The owner of this jaw must have lived several hundred years ago, for it is partially petrified.

Dr. Meriam.—I have always had trouble in finding a suitable clamp for lower bicuspids where the molars were lost, owing to the rubber tipping the clamp forward. Last fall I asked Dr. Ivory to make me one; he has followed directions carefully, and the clamp I show is the best I have used. The bow goes up at nearly right angles, and the leverage is but slight. Mr. Knapp offers to keep them if there is a demand. I show also a pair of tweezers. I cannot call them original, as since I had them made I have found a similar but stouter form in some of the trade catalogues. Mine

must therefore be called a modification, and will be found useful in reaching into deep cavities. They are short enough to be easily used at any angle. The cut I shall introduce shows them at half-size.

I had them made by Mr. Goldthwaite, on Washington Street, where they can be had, or ordered through any druggist or dealer in surgical instruments.

The regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms on June 3, 1891, President Seabury in the chair.

The paper of the evening was read by Thomas Fillebrown, M.D., D.M.D. of Boston; subject, "Vitality as a Germicide."

VITALITY AS A GERMICIDE.

BY THOMAS FILLEBROWN, M.D., D.M.D., BOSTON.

The reign of antisepticism has long been autocratic. Its disciples and advocates are enthusiastic and opinionated, consequently they are impatient of any expressions of possible doubt of the entire correctness of their positions. Hence it requires some considerable temerity to publicly argue against antisepticism, and put forward asepticism as the more important principle upon which surgical success depends, yet I feel that it is quite time to call the attention of the dental profession to the probability of the doubt, and ask a consideration of the latter position. More than fifteen years ago, at a meeting of the Merrimac Dental Society, I expressed the opinion that the power of micrococci over decay of the teeth was over-estimated; that bacteria alone in contact with the teeth were not sufficient to cause decay; and that certain favorable conditions must be present to enable them to act and cause destruction. I stated my belief that the essential condition was weakened structure, arising either from imperfect formation or from degeneration from some secondary cause; that until the vitality of the structure was weakened the bacteria were powerless. My observations during succeeding years, together with the results of the investigations of bacteriologists and pathologists, have strengthened my convictions, and to-day I feel that I am one of a "powerful remnant," to quote Matthew Arnold, which is sure to become a ruling majority.

Of general surgery I do not presume to have sufficient practical knowledge to enable me to speak with authority, and shall let surgeons speak for themselves.

For facts regarding bacteria I shall rely upon the investigations of experts in that branch.

Of results in treatment of the teeth, and the larger field of oral surgery, I feel that my observations are of some value. It has been

proved beyond a doubt that bacteria cause fermentation, putrefaction, and many diseases. It has also been proved and is universally admitted that fermentation and putrefaction never occur except by the action of bacteria; also that certain chemicals and extremes of heat and cold will destroy both the plants and their germs. But it is not generally understood or admitted that chemicals of sufficient strength to destroy the bacteria and their germs will seriously injure or destroy the tissue with which they may come in contact, nor has vitality of the tissues as a practically effective force to destroy the bacteria been sufficiently recognized. Hence vitality as a germicide is what I propose to consider at this time.

The work of the discovery and the identifying and classifying of microbes has been great, and has occupied a long time.

In 1516, Magnatus claimed that the air was full of infectious miasms; Wiseman, in 1692, held the same view, and in 1706, Parmanus speaks of a lotion which, applied to wounds, resists putrefaction and takes away the pain and inflammation from the wound. That yeast consisted of microscopic cells was proved in 1680 by Leeuwenhoek. That these cells were plants was shown by Tour in 1836. In 1837, Schwann found organic germs in the air, and connected them with the processes of fermentation and putrefaction. It still remained for Pasteur, in 1857, to first observe and explain the mechanism of the relations between fermentation and the vital processes of micro-organisms. Since that time knowledge of bacteria and their action has been rapidly acquired and classified, and now bacteriology is a well-established branch of science.

Delpech, Dupuytren, and Offenbach developed the "subcutaneous method" of operating, which proved so successful. This led to the efforts of J. Guérin and Chassaignac to convert open into subcutaneous wounds.

Soon after Pasteur's researches of 1857, it came to be accepted as a fact that all inflammations as well as fermentations and putrefactions were the result of the action of bacteria; hence, from these premises, Lister's theory that the exclusion of germs from a wound would prevent inflammation and degeneration, and allow immediate healing, was logical. As a result we have, in 1872, Lister's antiseptic treatment of wounds, which has become so famous and productive of so much good. The benefit of Listerism on the progress of surgery cannot be over-estimated, but it should be borne in mind that it was developed at the same time that greatly improved methods of operating were being introduced and the importance of

greater cleanliness was being recognized. Lister's genius led him to combine with his great ability the powerful adjuvants of antisepticism and cleanliness, but his modesty led him to ignore to a great degree his consummate skill as a factor in his system. Cleanliness, as such, appeared as only a necessary incident, while antisepticism was to him the basis and framework of his superstructure.

For fifteen years the proposition that antisepticism was the one essential principle on which surgical success depended was hardly questioned. Antiseptic surgery has in theory, though not in practice, ignored to a great degree the importance of three points which, with drainage, have together been the real foundation of the success of modern surgery,—viz., skill, cleanliness, and that other factor so long called "condition of the patient;" this, now, in antiseptic nomenclature, is included in "proper selection of cases," "early operations," etc. All these are circumstances which affect the one condition necessary to success,—vitality.

The bad case makes too great a demand on the vital strength of the patient, and he dies.

The early operation has the full vital power to resist the shock and make the repair.

Listerism, as a system, is based upon the antisepticism of chemical poisons, while the rational system is based upon the asepticism of cleanliness.

The principles upon which Listerism is based are, in their order, antisepticism, drainage, condition of the patient, skill.

The principles upon which the rational method rests are vitality, skill, asepticism, drainage.

Good nursing and nourishment are concomitants in either case.

A further observation of facts will make plain that antisepticism cannot be relied upon, and that it is the asepticism, which is the result of the antiseptic practice, which gives success.

The researches of scientists has established the fact of the existence of almost innumerable kinds of bacteria, varying in their degree of vitality, which cause the disorganization of organic substances, and also forms of pathogenic bacteria, which are the causes of infectious diseases.

The vitality of the disorganizing bacteria is much less than that of the healthy normal cell of animal tissue. The pathogenic germ requires some favorable conditions, not yet well understood, to give it power within the system.

The air around us, the dust under our feet, the food which we eat, and often the water we drink are filled with various kinds of

these bacteria. Hence no living being enjoys immunity from their presence.

Although now almost universally abandoned, the use of the carbolic acid spray was at first deemed an essential and indispensable adjunct in Listerian surgery. The carbolic acid (five per cent.), diluted by the steam from the atomizer, and then further diluted by the air into which it was injected, became so reduced that the final strength, which comes into contact with the bacteria floating in the air, is at most only a fraction of one per cent.

The puerility of this spray as a germicide is shown by comparison with facts established by recent observations made in laboratories.

Koch found that the bacteria in broken-down beef-tea were not destroyed in two hours in a four-per-cent. solution of carbolic acid. De la Croix found the same alive after immersion in a ten-per-cent. solution. Koch found that a one-per-cent. solution did not affect the anthrax spores in fifteen days; a two-per-cent. solution did not destroy in seven days. Hence a less than one-per-cent. spray for two hours would be harmless to the spores.

Dr. Prudden, of the New York College of Physicians and Surgeons, demonstrated—

1. That freezing killed a large number of bacteria.
2. That if the vitality of the bacteria is reduced by exhaustion of nutriment in the culture, great numbers are killed by freezing, but if they are vigorous this will not be the case.
3. Some species are capable of growth after long exposure. The typhoid bacillus resists freezing temperature for a long time.
4. In any given culture the resistance of individual bacteria varies greatly.
5. Alternate freezing and thawing destroy more effectually than constant cold.

The Société Médico-Chirurgicale, of Lyons, conducted a long series of experiments which established the following conclusions:

1. The action of steam under pressure is absolutely efficacious between 112° and 115° C. It destroys the most resistant germs after an application lasting fifteen minutes.
2. Hot air and superheated steam are of less value. At 130° C. certain germs escaped when the application of heat was prolonged twenty minutes!

Dr. Ernst, of the Harvard Medical School, in a paper read before the Harvărd Odontological Society, showed that the only sure way of sterilizing was by the application of steam at 212° F. for two

hours, as applied in Arnold's sterilizer, and suggested it as an available means of applying the steam for that purpose.

Now, if these observations are of any value and the conclusions reached are facts, how utterly useless it is to think for a moment of producing anything like antiseptic conditions in operations, and how evident it is that surgical success depends upon some other more important condition!

Antiseptic theories were promulgated and the system established when bacteria were considered to be the immediate cause of sepsis in all of its forms. Later discoveries have shown that bacteria have no power over living tissue, but that among the products of putrefaction are alkaloids called ptomaines, which are violent poisons, and which are readily taken into the circulation when brought into contact with an open wound, and cause blood-poisoning effects. A minute amount of the alkaloid will give rise to serious consequences. This is unquestionably the source of poisoning from eating canned goods, either meats or vegetables, or ice-cream. The vitality of ptomaines resists a high degree of heat, much greater than is necessary to destroy all forms of bacterial life; hence the matter is made very plain. The meat has, before canning, been exposed to infection and ptomaines developed. In canning, the meat is subjected to a heat quite sufficient to kill the microbes but leave the ptomaines undestroyed ready for work, and colic, vomiting, diarrhœa, lassitude, emaciation, and all the long line of ills which follow blood-poisoning are the result.

The action of these ptomaines, independent of any germs, may be learned from the following extract from Senn's "Surgical Bacteriology:"

"That putrid substances injected directly into the circulation produce symptoms of septic intoxication has been known for a long time, and the extensive researches of Panum threw additional light on the subject. It was believed that putrid materials, when introduced into the organism, induced a process of fermentation, to which were attributed the most constant post-mortem appearances found in septicæmic subjects,—fluidity of the blood and softening of the tissues. That these changes were not necessarily caused by the action of living micro-organisms was determined by experiments; as the introduction of putrid blood, or meat infusion that had been boiled for a considerable length of time, produced toxic symptoms, and, when a sufficient quantity was used, death and identical pathological changes in the blood and tissues, as in cases of true sepsis.

"Semmer (*Virchow's Arch.*, Bd. 83) gives an account of the action of septic substances as studied experimentally by Guttman in the pathological department of the veterinary school at Dorpat. The experiments were made with putrid substances, products of inflammation, septic blood, and cultivations of septic bacteria. These researches showed that a chemical putrid poison is formed in putrefying substances, and that a certain quantity of such poison produces symptoms of sepsis and death in animals. The blood of animals killed with such putrid poison was found to possess no infective qualities, and the usual putrefactive bacteria are destroyed in the blood, and only appear again after the death of the animal.

"Buiger and Maas have rendered valuable service in the chemical isolation of ptomaines from putrid substances, and the results of their inoculation experiments established more firmly the fact of putrid intoxication by ptomaines. The number of bacteria in rabbits killed by septic infection is so great that death may ensue from mechanical causes, while in fatal cases of sepsis in man the number is often so small that it seems natural to suppose that the micro-organisms are capable of producing some poisonous substances which destroy the patient before they have time to multiply to the extent observed in the septicæmia of rabbits and mice."

The statement has been made in the New York Odontological Society that the blood and tissues are full of bacteria. If this were the case, and it were true that bacteria caused putrefactions, we all should be indeed not living, but dead and putrefying.

The absurdity of the statement is shown by the following experiments:

Hauser (Vorkomen von Micro-organismen in "Lebenden Gewebe gesunder Thiere," *Archiv für Experimentelle Pathologie and Pharmacologie*, Bd. xx. pp. 162–202) has made a number of carefully-conducted experiments to show that no microbes exist in healthy animals.

The experiments consisted principally in procuring tissues prone to fermentation, as parts of internal organs, blood, etc., and protecting them against infection from without. He kept the specimens in rarefied air, in filtered air, hydrogen, oxygen, carbonic acid gas, and water, and in various artificial culture-soils, at a temperature favorable to putrefaction, but in all instances in which the specimens remained uncontaminated no putrefactive changes were observed.

By this method he believed he was able to demonstrate that tissues taken from healthy animals immediately after death con-

tained no bacteria, since it is well known that if the specimen were not perfectly sterile putrefaction would have taken place. The author did not only appear to demonstrate that living tissues contained no micro-organisms, but he also ascertained that the preserved sterile organs in time underwent a sort of regressive metamorphosis similar to that which takes place in the absence of micro-organisms, and what is of especial interest, that the product of such processes of resolution possess no poisonous properties whatever.

Watson Cheyne (on "Suppuration and Septic Diseases," *British Medical Journal*, March 3, 1888) found, in his experiments on the presence or absence of micro-organisms in the living tissues, that, while germs were absent when the animal was in a good state of health, yet if the vitality of the animal was depressed, say by administering large doses of phosphorus for some time, organisms could be found at times in the blood and tissue of the body.

Nelson, in a paper read before the American Academy of Medicine, and approved for publication, on "Micro-organisms and their Relation to Disease," says,—

"It has been a widely-disputed question as to whether bacteria ever occur in the animal in a perfectly healthy state; the affirmative view having been taken by Billroth and some others; but it is denied by Koch, by Pasteur, and by Ehrlich, who state that they have never detected bacteria in the healthy animal. The failure of putrefactive bacteria, according to experiments, would go to show inability to struggle against the normal cells indigenous to the soil upon which they were planted. Some bacteria showed power of existence only in tissue in which vitality had entirely ceased, while others seemed to possess the power of existence in the presence of the animal cells when the latter suffered from impairment of nutrition, and the tide of life was turning against them. Abnormal composition of the blood seemed to favor the development of some bacteria, after they had found their way into the tissues."

The relation of pathogenic germs to the healthy tissues is shown by the following, from Senn's "Surgical Bacteriology" (p. 25, *et seq.*):

"From these remarks it is reasonable to assume that pathogenic germs may exist in the healthy body without necessarily giving rise to disease, especially if, as is well known, they are being constantly eliminated through the excretory organs."

Fodor ("Bacterien in Blute Lebenden Thiere," *Archiv für Hygiene*, Bd. ix. p. 129) introduced directly into the circulation of

rabbits pathogenic bacteria in order to study their effects on the tissues and manner of elimination. As a rule, he found that they had completely disappeared from the blood after twenty-four hours. No culture-experiments were made less than four hours after inoculation.

He believes that the microbes are removed by leucocytes. He affirms that, as a rule, pathogenic germs are not present in the healthy organism, as he found the blood of healthy rabbits, without exception, sterile; and only in exceptional cases was he able to demonstrate the presence of bacteria in animals killed, even where the examination was postponed until after putrefaction had set in.

The phenomenon, familiar to every one, of blood effused into a contused wound being absorbed and the parts recovering perfect health, without any signs of putrefactive changes, is a clear proof that bacteria are not in healthy blood. Another proof is the fact that cysts form and contain tissue which is taken out of the circulation and has even undergone suppurative changes, and exist long as cold abscesses without a sign of putrefaction or even inflammatory action, and most of such cases will heal kindly if opened, drained, and kept clean.

The results of modern abdominal surgery show that cleanliness, and not antisepsis, is the right bower of success.

I believe the best record that Listerism has shown is to reduce the mortality to about eight per cent., while Lawson Tait, in his last thousand reported cases, without a pretence of antisepticism, but an entire avoidance of it, reduced the mortality to about three and one-half per cent. Mr. Tait had a run of one hundred and thirty-nine cases without a death, while Mr. Thornton, the most persistent apostle of Listerism of the present time, had only forty-eight cases without a death. The testimony of so successful an operator as Mr. Tait upon the harmlessness of germs upon the living tissue is worthy of attention and consideration.

I will quote in full his language upon this subject:

"For my present purpose, therefore, it is enough for me to assume, as I do most fully, that the germ-theory has been completely substantiated, and that no known putrefaction does occur, save by the admission of resting spores, or swarm spores of some of the many minute living organisms which are invariably associated with putrefactive changes.

"But concerning this, there is another constant position associated with this phenomena. The materials upon which the experiments have been made, of infinite variety of kind and constitution,

have all been dead, and no one has yet pretended that, by the admission of germs to living matter, he has produced the phenomena of the putrefactive changes which constantly result in matter which is dead. To quote the apt illustration given by Dr. William Roberts in his masterly exposition of this most difficult subject, the ordinary hypodermic morphia-syringe will inoculate inevitably a sterilized solution of dead organic matter, but among the hundreds and thousands of hypodermic injections which are made daily, no one has yet declared a single instance of putrefactive changes resulting from it in the healthy or even in the diseased human body.

"It will, therefore, be seen that the application of the facts of the germ-theory of putrefaction to the phenomena of disease of living tissue is met at once by an overwhelming difficulty, to the removal of which none of the adapters, so far as I have seen, have as yet applied themselves.

"Granting that the same germs which would inevitably produce putrefaction in a dead infusion of beef are constantly admitted to wounds, there is not the slightest particle of evidence that they do produce any change whatever upon living tissue, still less is there any evidence that the changes which occur in the numerous varieties of what we call blood-poisonings, even when they are of an undoubtedly local origin, have the slightest analogy to those seen in a putrefying dead infusion.

"The mere presence of bacteria in the fluids of wounds, or in fluids enclosed in cavities, while offering many difficulties to the adapters of the germ-theory, prove nothing for their positions until they have shown that these organisms ever do occur in fluids or tissues which are truly living.

"The difficulty, therefore, is this: that what we call vital action, for want of a name based upon a better understanding of what it is, places living tissue in an altogether different category from tissue in which the phenomena of life are no longer present.

"Now, this is consonant with every-day experience. If a decaying hyacinth-bulb or a rotten apple be examined, the presence of the minute forms of life is found to be absolutely confined to those parts where the changes have been effected, while those parts to which the rot has not extended are found absolutely free from them, and the difficulty of the adoption of the germ-theory is simply this: that its advocates have assumed that the invasion of the germs is the cause of the decadence of the vital phenomena and the ultimate death, while there is the alternative,—still undis-

cussed, and certainly undismissed,—that the decadence of the vital powers, due to some cause possibly yet unknown, is that which gives the germs their potential ascendency, and enables them to do what, during full vital action, they are wholly unable to effect.

"If the view of the germ-theorists were correct, we ought to expect that no operation could be done successfully without rigid antiseptic precautions. The slightest cut of the skin ought to be followed by septic poisoning. There ought to be no difference in the mortality of operations in small and large hospitals, in town and in country. In fact, if germs could have had the unbounded influence which is claimed for them by many antisepticists, surgery must long ago have been an extinct art, if, indeed, it could ever have struggled into existence.

"The uniform experience of operating surgeons has taught them that the success of their work will depend upon three factors,—the condition of the patient, the condition of his surroundings, and the nature and extent of the operation performed.

"Of these three, undoubtedly, the most uncertain factor is the first. What condition of the system it is which is favorable to operations is almost unknown. I must base my conclusions chiefly upon my own work, and in my special operation of ovariotomy I am perfectly certain that apparent perfect health is by no means a certain indication of a power of resistance to those conditions, whatever they be, which result in so-called septic poisoning.

"The second of these factors, the condition of the surroundings of the patient, contains elements of far greater certainty. It has approached the position of a statistical law that the death-rate is in constant harmony with the density of the population, and when the density exceeds a certain minimum of safety there are introduced specific septic diseases, as typhus fever, which are wholly unknown under other conditions, and which, even after the danger density has been reached, attack certain individuals only, and not all, for reasons which can be expressed only by saying, as I have already said, that the living tissues of those affected could not and did not resist the septic influence.

"Every advance we make in sanitation shows that this factor, the condition of the surroundings of the patient, is of extreme importance.

"The third factor which influences surgical success is the extent and importance of the operation performed. Everybody knows that while amputation of a finger is probably fatal in not more than

one in ten thousand cases, nearly one-half of all amputations of the thigh die. Now, if the adaptation of the germ-theory to surgical practice were as promising and legitimate as some of its supporters allege, we should have had the remarkable result, previous to its application, that amputation of the finger and the thigh ought to have approached one another in mortality to an infinitely larger extent than they have done.

"If the contact of a bacterium germ upon a wound could be the source of blood-poisoning, then the size of the wound and the nature of the operation could make but small difference in the result, and a wound into the theca of a finger tendon and one of a similar size into the peritoneum of another patient in the same ward ought to have very similar risks. But, as a matter of fact, they do not, and we are forced to the conclusion that, even if bacteria germs lighting on the wounds are the cause of much surgical mortality, the power of vital resistance by the tissues, or the condition of the patient and the nature and extent of the operation are of infinitely greater importance as factors in the general result."

No words I can add can make it clearer that vitality—life—is the one effective germicide upon which all surgical success depends. There are, so to speak, two kinds of vitality: the first, vitality of construction; the second, vitality of resistance.

The first is marked by a quick, full pulse, arteries and veins over-full of blood, a well rounded form that counts well in avoirdupois; this succumbs easily to destructive influences. The vitality of resistance holds on to life under deprivations, hardship, exposure, and famine. This is the vitality that those possess who live on through destruction and pestilence when thousands around them die.

In 1827, Bichat wrote, "Life is the sum of the functions which resist death." This life, it appears to me, consists of two forces: first, a power of forming, and second, a power of resisting. The first exerts the positive force of building up during the period of growth and keeping up the repair during middle-life and declining years. The second is a guard ever watchful to keep the system in order, and to stand always ready to resist the ingress of disease in all its forms. This resisting vitality is the true germicide. In the presence of this vitality no bacterium or germ can thrive or live.

Oral and dental surgery furnish illustrations of the positions taken in this paper. Wounds of any character of the mouth rarely suppurate, and but a very small proportion even inflame. Of the

vast multitude of teeth that are extracted every year, not one case in ten thousand is followed by septic degeneration. And where such degeneration does follow there is evidently impaired vitality. If bacteria in wounds were alone sufficient to produce sepsis, what dire results must follow so frequent operations as extractions! Complete drainage and constant washing with the secretions of the mouth keep the wounds aseptic, and hence the favorable results.

Again, the treatment of pulp-canals is an illustration. If a pulp is *completely* removed by operation, the cavity dried, and immediately filled, trouble will never occur in a healthy subject. If a canal is already septic and even causing irritation about the root of the tooth, there is no surer way of effecting a cure than to open the cavity, thus giving drainage, and allowing the scavengers to consume the *débris*.

Before the science of antiseptics was so fully developed, this expectant treatment was taught and successfully practised. Pulp-canals being closed cavities in hard tissue, impermeable to fluids, the use of strong antiseptics was not only unobjectionable, but of decided benefit in hastening the cleansing process. And the asepsis of cleanliness brought the successful result.

Finally, I will quote Professor Miller, who closes an exhaustive discussion of the prophylactic and curative effect of antiseptics by saying, "Under all conditions, however, the chief thing is the thorough mechanical cleansing of the teeth."

DISCUSSION.

Dr. Potter.—The most ardent advocate of antiseptic surgery would not undervalue the very great assistance rendered by the vitality of the tissues. Leucocytes have, without doubt, great germ-destroying power, but can we not in some way assist the vital power of the tissues?

To my mind there are several ways of so doing. First, by the mechanical removal of germs through washing. Secondly, by the drainage of wounds. Thirdly, by the use of substances which lessen the power and vitality of the germs, causing them to more readily yield to the germicidal action of the leucocytes; in other words, by an intelligent use of so-called antiseptics or germicides.

Dr. Briggs.—To any one who has given this subject thought, it must at times have seemed as though we had gone into this antiseptic treatment so thoroughly and with such enthusiasm that there would be a reaction, and that a time would come when with

more knowledge much of our present treatment would appear to have been unwise or unnecessary. It does not seem to me that we have reached that point yet. Dr. Fillebrown speaks of the agencies which were developed at the time Listerism came into vogue. I have not looked into the subject, and I may not be correct in my statement, but my impression is in regard to the matter of skill that there has not been such great improvement. The improvement has been in the courage to do, because results were found to be better when aseptic conditions were produced. Listerism, as I understand it, was not so much asepticism as it was carbolicism. For a long time the only thing used was carbolic acid, as though that was the main thing and not the underlying principle of cleanliness. Nature makes things clean by washing and diluting, and it is understood that germs must be present in some certain force to produce certain results. I think I have seen the statement about a small-pox hospital that the air-space of six hundred feet was sufficient to prevent infection. Now, there must be some germs beyond that six hundred feet, but they do not get there in sufficient force to do damage. In our efforts at antisepticism we dilute and disperse these germs, even if we do not kill them all, so that they are not present in sufficient numbers to work injury.

To go back to the point spoken of about the skill, I think that we do the former operators great injustice when we speak so much about modern skill. The matter of drainage is not so important in the most advanced surgery of to-day. At the Massachusetts General Hospital they now take a patient with a compound fracture, and after having washed the parts and made everything clean, they put that leg up in a plastic splint, and let it alone till the fracture is united. Formerly, as you all know, a compound fracture was considered one of the most serious injuries, and drainage was thought absolutely necessary in treatment. So there is something (it may be the cleanliness) gained by the use of antiseptics. While I think we have overdone the antiseptic treatment, I do not think we should regard it as a past principle, and cast it aside. The use of antiseptics should go hand in hand with cleanliness. While antiseptics do not kill all germs, they do kill some, and inhibit others, and meanwhile the vitality of the patient carries on its work of repair.

Dr. Williams.—I have always understood that the use of antiseptics was simply as a road to, and, in many cases, a necessary way to arrive at, asepsis. We must have it in some way, and in

some cases the leucocytes are not able to conquer the mischievous bacteria; then we must have some help, just as in many local and constitutional troubles we help nature to work in the way she wants to work. In our endeavors to get immunity from these morbid elements, whether we arrive at it by constitutional vigor or whether we help this vigor by neutralizing the enemy, we attain the same point. But we all know that constitutional strength is not always sufficient to overcome the enemy.

Dr. Briggs.—One word more. It is pretty hard to separate this absolute cleanliness from the use of antiseptics. I have not felt at any time that the use of strong germicides, so strong as possibly to be irritating to the parts, was necessary. Those are extreme ideas, but we do not have to go to the extremists to get the best methods, and it seems to me that if we wish to carry out the idea of making everything clean, cleanliness can be best obtained by the use of these antiseptics. We have got to use them on the instruments to destroy all possibilities of germ life, whether we give up the idea or not that a germicide must be used on the parts affected. If it goes forth that we can get along without antiseptics we are not going to get cleanliness, because our present means of sterilizing instruments is not sufficient unless we use those things.

The American Academy of Dental Science held its regular monthly meeting in the Boston Medical Library Association rooms, October 7, 1891, President Seabury in the chair.

President Seabury.—"Inflamed Pulps requiring Extirpation; how best to treat?" is the first item on the card. Has any one any communication or paper on this subject?

DISCUSSION.

Dr. Banfield.—The speedy removal of an inflamed pulp, giving the patient the minimum amount of discomfort, is a matter of considerable importance to ourselves as well as to our patients.

Its removal is accomplished by two general methods: First, through the action of some drug, thereby causing devitalization; second, through the use of probes and broaches. Few patients, however, are willing to submit to the latter barbarous operation. At the present time the destruction of the pulp by the first method is often attended with considerable disappointment, due probably to a stage of inflammation of the pulp which resists the action of the drug used.

A greater or less amount of pericementitis often ensues, rendering the use of arsenic, at this stage, of doubtful value. Our first thought, in cases of inflamed and aching pulps, is to apply some sedative, and, if possible, reduce the congestion. After such an application, we may still find the pulp in the course of a day or two very sensitive, and upon exposure to the air giving pain which is difficult to control. Unless very carefully inserted the application of arsenic at this stage is liable to cause pain, the pulp also resisting the action of the drug. It has been the custom of some operators, after an arsenical application has been removed and a remnant of pulp found to be still alive and sensitive, to use a combination of tannin and creosote, allowing it to remain for some weeks. I have, however, removed applications of this kind which have remained in nearly a year, and still found the pulp as sensitive as ever.

In view of the liability of extension of inflammation resulting in more or less pericementitis, it seems to me that whenever a pulp resists the action of arsenic or cocaine, the best treatment, for both patient and dentist, is to remove the pulp at once by probes, using an anæsthetic locally or otherwise, provided the pulp-canals are accessible.

We may hope that in the near future, through the use of cocaine

or some combination of it with other drugs, we may have better success in treatment of and extirpation of the pulp.

Dr. Williams.—In the early days of my practice, Dr. Harwood always advocated what was called "butchering the pulp,"—that is, taking it out alive. That was before the days of anæsthetics, and Dr. Harwood was very successful in this heroic practice. This method was not attended with the irritability of the root which sometimes follows the application of arsenic.

When pulps are inflamed, the inflammation should first be reduced before an application is made to destroy its life. To reduce this inflammation, I have found nothing better than bicarbonate of soda applied to the cavity on a loose pledget of cotton, and the surrounding parts saturated with chloric ether. This application may be left in place from half an hour to a day according to the extent of the inflammation. After this treatment the pulp is less likely to give pain in applying arsenic.

The pulp may be destroyed after an injection of cocaine, but if the pulp is inflamed, the puncture of a syringe-point must be a decided objection to this operation. Besides, the action of cocaine preparations upon inflamed pulps is uncertain. My general practice is to treat a tooth for the reduction of the inflammation of the pulp, then by applying a sedative combined with the arsenic I generally succeed in the destruction of the pulp or a large part of it. In case the whole pulp is not destroyed by an application of arsenic, my plan is to rinse out the canal and make another application, unless the vital fibre remaining is very slight. If that is the case, a weak solution of chromic acid may be carefully applied, this will cause no sensation, providing the root is well closed at the apical foramen. Care has to be taken to prevent the chromic acid penetrating beyond the foramen. Then introduce a fine probe wound with a little cotton saturated with lime-water to neutralize the chromic acid. After that wipe out the root with eucalyptus oil or cajuput, or any non-irritating antiseptic, and stop it up for a test to see if it will remain free from inflammation before making a permanent filling. Sometimes I use what I call a rod-stopping for the root-canals. This I make of tin and lead. I have used wooden fibre and whalebone, but the wood and whalebone were soft, and a properly-shaped metallic rod answers the purpose very nicely. An antiseptic may be put in if you choose, and then the rod, dipped first in chloro-percha, is introduced, leaving length enough for easy manipulation. After inserting the rod-stopping, seal up the external cavity, and give the tooth a rest for several weeks. Give it plenty

of time to heal before presuming to open it for the permanent filling.

If you need to give the tooth vent, you can pull out the rod, stopping without digging and working on a sore tooth. And yet, under ordinary conditions, the rod-stopping is just as good for security as the old-fashioned gold filling.

Dr. Banfield.—Do you use any particular proportion of bicarbonate of soda?

Dr. Williams.—No, sir; on a wisp of cotton take up as much as is convenient of apothecary's—not grocer's—bicarbonate of soda, and put it into the cavity, and cover it over with sandarach, to prevent the secretions from getting at it. It seems to reduce the inflammation more readily than anything I have ever tried. Where the pulp is resistant to the influence of arsenic, the bicarbonate-of-soda preparation seems, in some way, to help the destructive effect of arsenic. I have tried ammonia, but it doesn't appear to operate as well as bicarbonate of soda.

Dr. Barker.—There is one thought which has been frequently forced upon my mind in my practice, and that is, that both patient and operator are very apt to expect too much from the action of arsenic in an attempt to destroy the pulp. The previous speakers have noted the importance of reducing inflammation before we apply arsenic. The reduction of inflammation is ordinarily quite a simple matter, sedatives and antacids being useful in this connection. Very frequently we find the pulp inflamed and also strangulated. Simple depletion of the pulp in such a case may reduce the inflammation sufficiently to enable one to apply the escharotic with a reasonable promise of success. For a number of years I have noticed that most practitioners use arsenic in a fearful or timid way. They are afraid to allow arsenic to remain in contact with the pulp very long. Their rule being eight hours for ordinary cases, but, under no circumstances, longer than twenty-four. For a number of years, I have made it a rule not to remove the application under a week, frequently allowing it to remain in a month, and sometimes two or three months. The reason why dentists hesitate to allow arsenic to remain in contact with the pulp for more than twenty-four hours is because they are afraid of a sloughing or some complication they hardly know what. Where bad results have followed, it has been because the dentist has done his work carelessly, the arsenic being imperfectly sealed in the cavity. But if arsenic be applied carefully, after the adjustment of the rubber dam; if it be put in contact with the pulp and sealed in by

something more than a mere dressing of cotton, saturated with sandarach varnish, there need be no fear of the result. For the last four or five years it has been my practice to apply arsenic to an inflamed pulp carefully, accurately, making the conditions as favorable for its destruction as I knew how, and then sealing it with a temporary stopping, and allowing the arsenic to remain there ten days. In the vast majority of cases, after such treatment, the pulp will be dead in all its parts.

Mention has been made of the use of tannic acid after arsenic has remained in contact with the pulp for a length of time. I have used tannic acid in my practice to harden and toughen the pulp, so that instead of being obliged to take it out piecemeal, you can drag it out entire.

Nearly all patients, when you tell them that you are going to kill a pulp, expect that they will experience no sensation whatever. They are usually disappointed.

The point I wish to emphasize in these remarks is that the majority of practitioners do not thoroughly seal up the arsenical application, and do not allow it to remain long enough in contact with the pulp.

Dr. Williams.—I would ask Dr. Barker if he would allow arsenic to remain as long in the tooth of a child as in that of an adult?

Dr. Barker.—Certainly not. Good judgment would require that you should not allow it to remain as long in a tooth whose foramen was very large, or in a deciduous tooth, as in an adult tooth.

Dr. Williams.—All we want to get rid of is the vitality in the pulp-chamber. The more vitality we can allow to remain in the tooth aside from that the better.

Dr. Barker.—Of course no one contemplates anything more than the destruction of the pulp. We do not seek to destroy the contents of the tubuli,—that would simply amount to the death of the entire tooth.

Dr. Banfield.—I would like to ask Dr. Barker if, after allowing his preparation to remain in three or four weeks, he finds a little soreness of the tooth on filling it?

Dr. Barker.—Whether I allowed it to remain twenty-four hours or three months, I should expect to find a slight tenderness on percussion.

Suppose we apply arsenic to the pulp of a superior incisor. The moment that pulp is dead, absolutely dead, to the apex, it imparts inflammation to the tissues just outside of the foramen,

and you get a little peridental inflammation. The ensuing tenderness is almost pathognomonic of death of the pulp.

Dr. Banfield.—Whenever I have applied arsenic for the destruction of a pulp and the patient reports trouble, I at once nullify the influence of the arsenic, and make an application not only to remove the inflammation, but to make sure that it goes no farther.

Dr. Williams.—If inflammation of the tooth occurs after the application of arsenic, I at once employ some means for reducing it.

Dr. Barker.—A slight amount of peridental inflammation in such cases doesn't alarm me. I look upon it as an invariable accompaniment of the death of the pulp.

Dr. Meriam.—We ought to take cognizance of the inflammation that occurs in the presence of pulp stones, or the deposit of secondary dentine, which is extremely hard to penetrate, and where the use of anæsthetics would hardly avail us. As our remarks are read by men younger than ourselves, we should frankly state our difficulties.

We should also take cognizance of the extreme difficulty of removing many pulps quickly, and that pulps are not all formed on regulation lines; that the majority of those that require extirpation to-day are diseased or partially dead, and are in the molar teeth, and that there can be no royal road for their removal in the anterior roots of the first lower molars.

I have had several cases where, after arsenic had remained in a week, I have found sensitiveness, and in one case I worked up into the pulp-chamber and removed the secondary dentine at the entrance to the roots, taking out little plugs like stoppers of glass bottles.

I have found peroxide of hydrogen of advantage in the treatment of partially dead and inflamed pulps previous to the application of arsenic. I do not know that it has the permanent advantage of bicarbonate of soda, but it has a use previous to the application of soda.

President Seabury.—When the pulp is devitalized there must be a certain amount of inflammation in order to slough and cut off connections with surrounding parts.

Dr. Smith.—I regret that Dr. Briggs is not here to-night to elucidate his method of treating pulps, inflamed and otherwise, which require extirpation. You are probably familiar with a paper he read before the Harvard Odontological Society and published in the INTERNATIONAL DENTAL JOURNAL a few months ago. His

method was to approach the pulp carefully, obtunding it by the use of a solution of cocaine, then by using a hypodermic syringe, on which he has substituted a blunt nozzle for the hypodermic point, to inject the cocaine into the pulp-chamber,—not into the pulp, but around the pulp. According to his report, he has in all cases been able to remove the pulp, fill the canal, and seal the cavity at the same sitting. Dr. Hamilton has also spoken of several successful operations in which he used this method. I have tried it in two cases, both of which were successful.

I have recently used Dr. Harlan's method of making an application of arsenic, iodoform, and cocaine mixed,—the proportions I cannot give you now from memory. This he allows to remain in the cavity for forty-eight hours, then he corrects the influence of the arsenic by the use of dialyzed iron, and then treats the pulp with an alcoholic solution of tannin, which he allows to remain for eight days. At the end of eight days your pulp is tanned, and is easily removed, and, if no secretions have gotten into the cavity, you can seal the canals with success. I have tried this method in several cases, and was successful.

President Seabury.—The next subject is, "To what Extent can Decalcified Dentine be left in Cavities of Decay when using Germicides?"

Dr. Fillebrown.—There should not be, in my judgment, much difference in the amount of tissue left, whether there be germicides used or not. The truth of that statement can be ascertained by considering for a moment the progress of decay, which is, perhaps, better described by Magitôt and Heitzmann than by any other authors. As I understand it, decalcification goes on to some considerable extent, and then the animal matter of the tooth is exposed to the action of the putrefactive bacteria which break down and destroy the matrix-substance. The discoloration extends into the dentine much farther than actual decay; and the microbes can, and do, force themselves into the tubuli of the teeth to a considerable extent beyond any softening, I should say to the depth of several lines. This is much farther than it is possible for any fluids to penetrate the tubuli of the teeth.

The point I wish to make is, that it is impossible to place in a cavity any substance, either in the form of a solution or otherwise, which will go far enough to reach all the destructive microbes. By dehydrating the tooth-substance, if that were possible, fluids could be made to penetrate more of the dentine than under normal circumstances. But still sufficient penetration could not be produced to reach all bacteria.

Therefore, you must depend upon something besides germicides to stop their action.

Dentine, when so far disorganized that it has lost its vital connection with the normal dentine of the tooth, cannot with safety be left in the cavity. It is claimed by some that it will regain its vitality after the decay has been arrested.

We know that decalcification may go on to a large extent and still the matrix may preserve its vitality, but dentine when softened and beginning to break down cannot be restored, and becomes an irritant instead of a protection, and is unsafe to leave in the cavity. Gutta-percha, cement, or some of the softer fillings, would be equally protective and less harmful to the pulp than disorganized dentine.

Dr. Smith.—I was led to present this subject for discussion from observing among my fellow-practitioners, especially among the young members of the profession, a great tendency to leave decalcified dentine, a punky condition of decay, in the cavity, and then fill it with oxychloride and oxyphosphate of zinc. The fact that they use the rubber dam and a strong germicide excuses them from thoroughly excavating the cavity, and they seem to feel that in this practice they are following the most advanced methods.

I was brought up in a different school, and was taught by that vigorous operator, Professor Moffatt, to thoroughly excavate.

Hard and discolored dentine might be left rather than expose a pulp, but not the leathery and punky dentine. The many cases of incomplete excavation of cavities which have fallen into my hands, teeth filled according to the method outlined above, do not bear out the statement that it is always a successful method. Operators who follow it do not excavate more because they believe that decay can go no farther after the use of germicides, and that the application of the germicide renders extraction unnecessary. If it does, then I am causing my patients unnecessary pain and taking up their time and my own. The remarks of Professor Fillebrown bear out my ideas on this matter: it is dangerous to leave this punky and leathery dentine in the cavity with the expectation that a germicide will prevent the further progress of decay.

Dr. Williams.—Cavities should be carefully excavated, and no morbid dentine should be left except such as is necessary to protect the pulp. If there has been no inflammation of the tooth, and you find a layer of softened, decalcified dentine over the pulp, there is no excuse for excavating that. To-day I gave a prelim-

inary treatment to a tooth in which I simply excavated the borders, but the depth of the cavity was so very near to the pulp that I could jar it. The cavity was treated with mild antacids and antiseptics, and stopped up temporarily. This treatment will be renewed at short intervals, giving the pulp time to protect itself by a new deposit, so that by and by it can be permanently filled. I had a case, years ago, where I used this method, and which was alluded to in a paper before this society. It was the pulp of a molar which I thought was exposed. I could almost see the pulp, and a very slight pressure caused pain. It was in the case of a healthy young person of perhaps twenty-five, and was treated in a way that I described in that paper,—repeating mild applications at short intervals, the intervals growing longer as the tooth became harder, and allowing ten months to elapse after the last application. On opening the cavity it seemed the attempt was a failure; I thought I could see the pulp as at first, but on passing a probe down carefully, it was found there was a new dentine, transparent as a piece of glass, completely protecting the pulp. I remember lining that cavity with non-conducting material and filling it permanently. In the course of about three years afterwards the same tooth decayed on the distal side, and was very sensitive, showing that the pulp was still alive. If I had excavated rashly in this case there is not much doubt that there would have been a dead pulp. I think it is better to swab out the cavity with weak creosote and some slight antacid than to excavate almost to the surface of the pulp and put in osteoplastic with its strong acid, which hardens to a solid body and is relentless against the fine pulsations of the pulp.

Dr. Meriam.—We should take into consideration the time we wish a tooth to last. This would make a great difference in our treatment of the temporary and permanent teeth. The idea that an enduring operation can be built on an uncertain foundation should not occur to a well-trained dentist. If we spoke of germs as seeds I think we would understand this matter a little better. Now, what will destroy the life of a germ or seed? So far we have found but one real germicide, and I believe at Johns Hopkins some experiments have shown that for some germs even that (corrosive sublimate) is not a germicide.

If we would realize this and learn the time and treatment that a scientific man would devote to sterilizing any substance, and regulate our treatment by the knowledge thus gained, and expect to be governed by the principles involved, we should in time have

some laws of practice to follow and not a mere "*ipse dixit.*" Dentists cannot work contrary to physical laws any more than can others. "Two bodies cannot occupy the same space at the same time." We cannot saturate with a germicide a substance that is already saturated with moisture, unless it can unite with it, and in uniting the germicide may be weakened below its working strength.

We should dehydrate if possible before using a germicide, to secure its penetration.

Nature seems to protect germs of all forms for reproduction. It is recorded that a bulb of Bulbocodium monophyllus showed life after being in a case of specimens, many of which were preserved with arsenic, for over twenty years. Some years ago I called the profession's attention to the coating of the teeth by mucus, and that it would in some cases prevent medicines acting on them, and I have recently been much interested in the experiment conducted at the Dead Sea with its water and the slime or ooze brought down by the stream that runs into it.

The water of the sea was tested in various parts and found to be absolutely sterile, but the mud drawn from its bottom contained germs that were isolated and cultivated. They were in water in which no animal or vegetable life exists, but being protected by the slime or ooze they have been found to retain their life. Now, in view of such retention of vitality, we should not attribute so much virtue to merely slushing a cavity with agents that are not germicides.

Some thirteen years ago, in treating the sensitive teeth of a child, I cauterized them with nitrate of silver, and afterwards without excavating filled with gutta-percha. This completely arrested decay. One of the teeth was afterwards extracted for regulating, and I had a good opportunity to study it. I hope that some time we shall encourage young men to devote some of their chemical training to our specialty, and some future Harvard man may give us a white caustic that will be sightly, and yet as effectual as the unsightly nitrate of silver is.

Dr. Williams.—Dr. Meriam's remarks about nitrate of silver remind me of a method which Dr. Keep tried many years ago when I was a student in his office.

He used nitrate of silver, and afterwards nitric acid, for cauterizing softened dentine which he wished to leave as a protection to the pulp. That process sterilized pretty effectually, but it also sometimes destroyed the vitality of the pulp.

The dehydrating of the tooth-substance, as Dr. Meriam says, is

very essential in order to force medicinal applications into the tubuli. Applications can be made more penetrating by the addition of a little alcohol.

As to what Dr. Fillebrown said about germicides not penetrating the substance of the tooth, I think if he were to try first a solution of iron, and then, without removing the iron, apply tannin and insert a filling, he would find he had made ink in the tubuli, and I do not see why it is not reasonable to expect that our corrective agents may penetrate in the same way.

PRESENTATION OF SPECIMENS.

President Seabury said he had a syringe which he valued very highly. The barrel was made of glass, with a platinum point drawn out very fine, making it very serviceable for injecting fluids into root-canals. It also had the advantage that when it became clogged the point could be put in the flame of a lamp and the matter burned out without damaging the point.

Dr. Smith exhibited a set of taps and dies which were made, according to his directions, by S. W. Card, Mansfield, Mass. They were used in making screws, nuts, and jacks, especially in connection with regulating appliances, and he said the advantage which they had over those to be found at the dental depot was that they cut the right size of wire and also a much stronger thread. The set he showed included four different sizes and cut sixty-four threads to an inch, and one of them cut a left-handed thread, which he used in connection with the Shaw plate for spreading the lower arch.

Dr. Adams showed the model of a case of a nervous old gentleman where he had banded three loose teeth together and then made a plate to supply others that were lost. Two years afterwards their removal became necessary, and the band, together with the incrustation of tartar, made it possible to extract them all at once.

He also showed an appliance for holding the rubber dam in place. It consisted of a piece of piano-wire, three and a half inches long, bent to about a quarter circle, with a small knob at each end, and a loop in the middle. It is applied after the dam is in place, the latter being stretched over the ends and over the middle loop, which draws it away from the mouth in three directions, producing very much the same effect as the depressed dam.

Dr. Meriam read from the "Horticultural Year Book," published in England, an article on the preservation of fruits and vegetables by the insertion of plaster of Paris in decayed places, and Dr. Wil-

liams said that he remembered when a boy of seeing a farmer filling up decayed places in a lot of apples with slacked lime for the purpose of preventing further decay.

Dr. Meriam also presented a syringe which he had improvised by using an ordinary hard-rubber syringe and inserting a long piece of platinum and iridium tubing in place of the usual point. It had served admirably in treating a fistulous tract.

BICHLORIDE OF MERCURY IN DENTAL PRACTICE.[1]

BY DR. GEORGE S. ALLAN, NEW YORK.

As to my employment of mercury bichloride, I would say that for some years past I have used it more freely than is customary in the profession, and with much satisfaction.

There is little doubt in my mind that it is one of the most powerful germicides we possess; that its use is not attended with any special dangers, and that most of the objections that have been urged against it are largely fallacious and misleading, and due to a lack of knowledge as to its properties and combinations.

In the last year there have been several notable articles in the journals relating to the subjects of infection, disinfection, sepsis, asepsis, and sterilization of dental instruments. They all lay stress on the importance of the subject, and the great danger that a lack of proper care and attention may entail. Their general drift may be summed up in brief: that sterilization of instruments, etc., is necessary, and, in a measure, obligatory; but that ways and means are not easily attainable, and in some cases not at all.

Dry heat is the most efficacious means to employ to destroy germs, and they fall back on the oven at about 300° F. as the best attainable method to adopt.

To all this I have no special objections to offer other than the manifest one, that it does not meet our wants. Dry heat will destroy germs most assuredly; but who can afford to keep his instruments in the oven half the time, or give it the requisite care and attention? Who can afford the large number of duplicates required where certain instruments are not only in daily but hourly use, and are picked up, maybe, a dozen times or more a day, let alone the complete failure of said means to meet the case of the mouth-mirror, syringe, etc.?

What the dentist wants is something always ready, available, and efficient. If he cannot stop to cook his instruments, he can take the time to wipe them clean and dip them into a cup or dish containing a germ-destroying fluid.

I have, then, mercuric bichloride on my shelf in a bottle, containing a one-per-cent. solution. When wanted, I prepare from this

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[1] Remarks made at the Twenty-fourth Annual Meeting of the American Academy of Dental Science, Boston, November 11, 1891.

a solution of the proper strength, one to one thousand; but instead of water I take rose-water. The bichloride solution simply has a very disagreeable taste; but if a mixture is made of one-per-cent. solution bichloride and rose-water, in proportion of one of the former to nine of the latter, you have an equally efficient preparation, and the nasty bug-poison taste of the simple liquid is supplanted by an agreeable rose-flavored one. This, then, is the mixture the use of which I advocate.

Into this fluid I freely dip any or all of my instruments, and as freely pass them into the mouth and around the teeth and gums. The instruments are never injured by the operation, and are easily kept clean. All instruments that have been dipped into water and wiped clean and dry can have only a thin layer of germs attached to them, and these will be reached at once by the solution and destroyed. I also constantly dip my mouth-mirror into the same fluid, and find that it is in no way injured by it; on the contrary, all parts of it are kept the brighter and sweeter. My syringe, a metal one, is also kept in good condition by its use, and I find now that patients, instead of asking me what the nasty stuff I have in the glass is that I have washed their teeth with, wonder where the delightful rose-taste comes from.

In cleaning teeth I dip the steel scalers of all descriptions and sizes constantly in the fluid, and then apply them to the necks of the teeth, and feel certain it is a beneficial operation. Infection can be carried from one part of the mouth to another, but by this means all danger is averted.

I have repeatedly noticed the rapid and healthy healing of the gums and soft tissues, after extended and even painful lacerations, resulting from this operation.

The instruments I exhibit—scalers, scrapers, mouth-mirror, and syringe—have been dipped into the solution hundreds of times, and, as you see, show no indications of other than ordinary use.

I would add that the rose-water solution is equally valuable in case you desire to cleanse and wash out a pocket or an abscess, and your patients will thank you for giving them so agreeable a taste in their mouths, instead of the ordinary disagreeable one.

In preparing the solution, you must not forget that plain bichloride decomposes; and even if you employ a freshly-prepared solution, you fail to get the best effects, owing to the albumen-coagulating power of the agent. Common salt in equal proportions with the bichloride is efficient; but probably the tartacid sublimate

tablets are about the most quickly available and efficient condition in which to keep the article. One of these tablets mixed with a pint of water makes a one to two thousand solution. Apparently this solution does not change, and does not coagulate albumen.

Another tablet is composed of ammoniac chloride and mercury bichloride in equal proportions.

METHODS OF FILLING TEETH FORTY YEARS AGO.[1]

BY FREDERIC N. SEABURY, D.D.S., PROVIDENCE, R. I.

Forty years ago dentists did not have cohesive gold, did not have rubber dam, did not have the mallet in any of its forms, nor the dental engine, nor at least a score of other instruments now deemed essential to properly equip an operative dentist. And yet teeth were filled then, and filled well. I believe the percentage of success was as high then as it is now.

When I started out from the Baltimore College, in the spring of 1849, I had an outfit of instruments of better quality and larger variety than the average student of that time; but I could easily have tied the whole lot in my pocket-handkerchief.

Soft gold-foil was as well made as at present. Tin-foil was made, but the use of it was not considered respectable; and as for amalgam, in the minds of a large majority of the leading dentists to use it was almost a crime. The feeling was that any tooth that could not be filled with gold had better be extracted.

It is not contemplated in this short paper to describe the different operations or treatment in vogue for preserving teeth at the time of which I speak, but to confine the paper and the discussion that may follow to the methods and some of the instruments used in filling teeth forty years ago.

In what I shall say I have in mind a simple cavity in the grinding surface of a molar, my object being to show the principle, and leave its application to the varying conditions as they are found in actual practice to your well-trained judgment. Contouring was only possible to a limited extent, as this system of filling required retaining walls.

In preparing a cavity, the rule was: If the depth of the cavity

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[1] Read at the Twenty-fourth Annual Meeting of the American Academy of Dental Science, Boston, November 11, 1891.

was equal to the diameter, the walls should be straight and parallel. In shallow and compound cavities the judgment of the operator must govern as to undercuts and retaining points.

In preparing the gold, two forms were in use. At the Baltimore College they rolled the gold into ropes, which were folded into the cavity, requiring that each loop should touch bottom, and stand out about one-fourth of its length. These loops were carried against the sides of the cavity with as much force as possible, great care being taken that no fold, after being placed in position, should be allowed to move. When no more folds could be carried to the bottom of the cavity, a wedge-shaped point was forced between them, and the gold carried each way against the walls. The hole thus made was plugged. This operation was repeated until the wedge-point could not be thrust in, when, with slightly serrated pluggers, the gold was pressed upon with all the strength the operator could exert, until it could be settled no more. Then with burnishers, hand-burs, and files the filling was cut back and finished.

The other method, and one taught me by my first preceptor, was to form the gold-foil into pellets ; but the same principle governed. Each pellet was to touch bottom standing parallel, and leave sufficient gold standing out of the cavity to condense properly without being driven below its margin.

The difficulties in this kind of filling, which seems so simple in the description, are probably as great to a novice as any other. As I have said before, the gold must lie where it is first put, and on no account be moved in working in other pellets. The packing must be even all through, so that at the final condensing there shall not be hard and soft places in the filling. The amount of gold put in must be so calculated that the last piece may be carried below the surface, and condensed into the centre of the filling; for if the last piece comes out, or, from not being carried in, flakes off, you will have an imperfect filling, which will probably tumble out. But where these conditions are complied with, the filling may be condensed into a firm and practically solid mass, that will finish up well, and preserve the cavity from further decay. As a system of filling, it commends itself, first, for saving of time; second, less annoyance both to patient and operator; and, third, durability. I will agree to fill the cavity I have been considering, and finish it up, while another man is adjusting the rubber dam with the clamps and weights provided to keep it in position, and with very much less discomfort to the patient than is occasioned by all the paraphernalia made necessary to keep a cavity absolutely dry, so as to make

a cohesive filling possible,—absolute dryness not being essential to the perfection of a wedged or soft gold filling.

There are plenty of fillings in the mouths of elderly people that have been doing good service for many years, that were put in, as we used to say, submarine; for if the gold is well put in, no man can tell the difference between the wet and dry, either in finish or durability. I sent to Dr. J. Foster Flagg a lower molar, with stopping on the buccal surface near the neck, that was filled by his father over fifty years before, in a position where I am sure he could not have kept it dry. The filling was in place, and the tooth perfectly preserved, it having dropped out from old age.

THE regular monthly meeting of the American Academy of Dental Science was held at the Boston Medical Library Association rooms on Wednesday, December 2, 1891, President Brackett in the chair.

A paper by Forest G. Eddy, D.M.D., subject, "The Use of Gutta-Percha as a Root-Canal Filling," was read.

THE USE OF GUTTA-PERCHA AS A ROOT-CANAL FILLING.

BY FOREST G. EDDY, D.M.D.

I bring before the society for discussion to-night my experience with gutta-percha as a filling for root-canals. I claim no originality, but rather present my gleanings from the operations of those in our profession who have made a success in the filling of root-canals and the saving of the natural teeth in a healthy condition. Some one has said, "Success in preserving devitalized teeth depends almost solely upon the individual skill of the operator, and possibly somewhat upon the materials used." To me the material used is a marked factor in relation to success.

We, who live in malarious districts, are beset in our practice with roots of teeth difficult of access, with their flattened and tortuous canals filled with pulps exposed, disintegrating and suppurating. To overcome these troublesome members, and bring them under subjection in as short a time as possible, is no slight strain upon the already overtaxed nerves of the busy dentist.

Here you have the most common methods: Root-canals with a drilled vent,—a discharging sewer. Root-canals with pulp removed and not filled,—a catch-basin for sewage. Again, canals filled with cotton, with iodoform, wood, lead, tin, oxychloride of zinc, gold, and gutta-percha. Skilled operators have made a success in the use of all these methods and materials in filling the canals of teeth.

The material that is simple in its manipulation, the method that may be acquired by the majority, should rank first.

Gutta-percha seems paramount in value. The nature of this substance and its properties have been well described to us by our associate, Dr. Meriam,—its non-elasticity; its wood-like hardness and toughness when cold; its being soft and easily moulded at high temperatures; its insolubility in water, alcohol, dilute acids, and alkalies; its ready solubility in bisulphide of carbon, essential oils,

and chloroform. I think it advantageous to use it in both conditions, hard and in solution, in the filling and closing of canals: hard, in the form of small pellets and cones; soft, dissolved in chloroform, which is the method in common use. Then to this solution of gutta-percha—"chloro-percha," as we call it—I add an equal bulk of oil of eucalyptus and oil of cassia,—the essential oils holding the gutta-percha in solution after the chloroform has to some extent evaporated. You all know how difficult it is to carry chloro-percha into canals from the rapid evaporation of the chloroform, leaving the gutta-percha sticking to the instrument rather than to the walls of the cavity.

A prominent, an essential factor to success is that the root be in an aseptic condition. Operators differ in obtaining this result, as they do in the use of different materials in closing the apical foramen and filling the canals.

Dr. H. Storer How says, "All methods are defective in which the operator does not know that he has closed the apical foramen."

The antiseptics of to-day are familiar, and the list is constantly increasing. The foremost writers upon antiseptics now advocate abolishing, as far as possible, all escharotics and coagulants in the treatment of septic conditions of root-canals. No antiseptic in use by the dentist answers these conditions so well as peroxide of hydrogen and the essential oils. They are non-escharotic, non-toxic,—yet antiseptic and stimulant; the manner of their use is simple and positive.

In case of immediate extirpation of the pulp by means of forcibly inserting a plug of wood,—this being preceded by an injection of cocaine, or the patient being under the influence of nitrous oxide gas,—I at once wash the cavity with hot water, to stop the hemorrhage; dry out the canal with cone of bibulous paper, in the manner described by Dr. Smith Dodge, of New York; churn out the canal with peroxide of hydrogen, instead of carbolic acid, as an antiseptic; then re-dry canal and fill with solution of gutta-percha in essential oils, which is easily worked to the apex and adheres to the walls.

Into the canal filled with the solution, carry a small piece of warm gutta-percha, gently and firmly, to the apex, following with the hard cone. The surplus solution will be forced out, and the hard cone of gutta-percha will be cemented to the walls of the canal. It will be seen that I differ here from Dr. How, if I may be permitted to again quote from his article, in which he says, "The fluid or soft plastic methods are defective, because it is only sup-

posed, but not known, that the foramen is, in fact, tightly closed, to say nothing of the mischief likely to follow the probable forcing of the solution through the foramen."

If the pulp be in a suppurative and disintegrating condition, we remove the *débris*, using the peroxide of hydrogen from time to time to clean the cavity as we proceed, and dress the root with fibre of cotton or silk, saturated with oil of cassia or other essential oils.

When the root is in a healthy condition, fill with gutta-percha in the manner before described.

The root having a fistulous opening, the canal is cleared of *débris*, and filled with peroxide of hydrogen. By a piece of soft unvulcanized rubber and a blunt instrument used as a piston, the peroxide is forced through the canal and out of the fistulous opening, the whole tract being left in an aseptic condition. After again drying the canal, the solution of gutta-percha is forced in similar manner through the fistulous opening, closing the canal, as before, with gutta-percha.

Frequently, after filling the canal by some of the old methods, a slight discharge would continue from the fistulous tract; but never have I had a case that would not yield to the above treatment. My theory is that the old sac at the apex of the root is distended and filled with the solution of gutta-percha, and this remains encysted. Some inflammation often results from forcing the solution of gutta-percha through the fistulous tract, but in a day or two at most it usually subsides.

In the treatment of root-canals I have used the peroxide of hydrogen for eight years faithfully, it being first brought to my attention by Dr. Crittenden, of Madison, Wisconsin. I have used gutta-percha in different and various forms for about the same length of time.

From working upon and refilling canals that have had cotton, oxychloride of zinc, wood, and metallic stoppings, I am led to think of gutta-percha as occupying the foremost position in the closing of roots of teeth that are devitalized.

I have taken the liberty, and I know you will allow it to me, to bring a few extracts from the records of work done in my office upon devitalized teeth.

From November 1, 1890, to November 1, 1891, a period of twelve months, I find the canals of one hundred and fifty-two teeth successfully filled after the manner described. To classify them a little more thoroughly, there were fifty-seven molars, fifty-seven bicus-

pids, eight cuspids, seventeen lateral, and thirteen central incisors. During the same length of time but two were removed as complete failures. Both of these were most faithfully operated upon, and I consider their loss and the failure due to the low vitality of the patients.

I am led to advocate this method because the antiseptics as used are not coagulants, and are not escharotic; because of their non-irritating character in relation to the soft tissues; and because of their pleasant odor in the office. No creolin, creosote, or iodoform is used in my office.

DISCUSSION.

Dr. Briggs.—I am very glad to hear this encomium upon the use of gutta-percha as a root-filling. Ever since hearing a paper read some years ago by the late Dr. Whitten, on immediate root-filling, I have followed the plan which he then laid down. I believe he afterwards changed the filling material from gutta-percha to oxychloride of zinc, on account of the antiseptic properties of the latter substance. My experience, however, in treating severe cases with gutta-percha was so satisfactory that I thought it unnecessary to make a change.

I have nothing to add to the paper, and endorse it fully in all its details.

I want to speak more particularly of filling roots having fistulæ. In such cases it has been my custom to pump liquid gutta-percha through the root-canal, and follow it with solid gutta-percha until a line of liquid gutta-percha appeared at the fistulous opening. Where this plan has been followed cases have been particularly successful. I had a gentleman in my chair to-day for whom I accomplished this result. About nine years ago he came to me for the treatment of the right inferior first and second molars, both teeth having fistulæ opposite their roots.

These fistulæ had been discharging for years. The roots had been filled according to another method by a very careful operator, but the teeth were loose as a result of their fistulæ. I drilled through the roots with a large drill, got a free opening, and filled them, so that the gutta-percha came out through the fistulæ as I have described. Of course the teeth were a little sore; but the gum healed and the teeth tightened up, and to-day the gum is perfectly normal, except that it is full of cicatrices.

That case was a type of a number of cases, which led me to feel that you must fill thoroughly,—not only the root itself, but

often through the root,—with a substance compatible with the tissues, like gutta-percha. The tissues encyst it as they would a leaden bullet.

You may say that oxychloride of zinc would have the additional advantage of being an antiseptic; but the point is, to make the root aseptic before you begin to fill.

Dr. Banfield.—I would like to ask Dr. Eddy or Dr. Briggs whether, in an anæmic person, after gutta-percha is forced through the fistula, they would expect the tissues to heal as quickly as in a more healthy person?

Dr. Eddy.—Not so quickly. There is enough free acid in the peroxide of hydrogen to break up the old tract; what is not encysted is thrown out in two or three days.

Dr. Brackett.—Does Dr. Eddy insert the solution of gutta-percha immediately after cleansing the root?

Dr. Eddy.—I do where a fistula exists.

Dr. Grant.—I would like to ask Dr. Eddy if he can say whether there is an antiseptic property in chloroform?

Dr. Eddy.—I cannot say. I use chloroform to dissolve the gutta-percha, and the mass of chloro-percha is mixed with an equal proportion of an essential oil, such as eucalyptus. The substance then becomes of such a nature as to readily stick to the walls of the cavity.

Dr. Grant.—My idea is that chloroform is an antiseptic. I have sometimes thought that the chloroform had as much to do with the success of this treatment as the previous antiseptic applications.

Dr. Eddy.—There is hardly any chloroform in the solution that I use. It is evaporated. My method is to dissolve gutta-percha to the consistency of thick cream, dip an old Donaldson's broach into the solution, and fill not only the canal but the whole pulp-chamber. Then with a piece of unvulcanized rubber and a blunt instrument, used as a piston, force the solution of gutta-percha through the canal and fistulous opening. If there is no fistulous opening, then smear the walls of the canal with the solution, and at once carry a hard cone of gutta-percha to position.

Dr. Clapp.—Without causing considerable pain, I have had the greatest difficulty in getting creamy substances into such fine roots as have not a fistulous opening. Air prevents the solution from going in, and I feel that the chances of forcing gutta-percha to the end of the root are very slight. The only way I can satisfactorily accomplish this result is by first filling the root with some essential

oil, either eucalyptus or some other, and following that with the solution of gutta-percha. Capillary attraction will assist in carrying it in. If I attempt to put chloro-percha into the root without first using an essential oil, I feel that I fail almost every time.

Dr. Briggs.—The gutta-percha which I use is pure, not that which we use for stopping, which may be gutta-percha and oxide of zinc and some other substance, but simply the pure gum dissolved in chloroform, with the essential oil added.

Dr. Eddy.—I use the same thing; it is about seal-brown in color.

President Brackett.—Where is this pure gutta-percha obtained?

Dr. Eddy.—In any rubber-store.

Dr. Banfield.—Will Dr. Eddy please state just the proportions in the mixture?

Dr. Eddy.—There are no special proportions.

Dr. Eames.—I am in accord with what has been said in regard to the efficiency of gutta-percha for filling canals, and would say that I am very much indebted to Dr. Clapp for showing me how to fill canals in a way similar to that described.

I have very frequently noticed the fact that pain has been occasioned by forcing the filling material into a canal, and I attributed it, as Dr. Clapp has, to the pressure of air within the canal. When such has been the case, I take a much finer instrument and fill less rapidly.

To give compactness to the filling, I have been in the habit for three or four years of forcing gold and platinum wire, and more recently copper wire, into the gutta-percha mass, and leaving it there.

Dr. Eddy.—I have a patient who has a tooth, the root of which was filled with cedar-wood by Dr. Seabury twenty years ago, and it is in just as good condition to-day as it was when filled.

Dr. Seabury.—I have used cedar-wood for more than thirty-five years, and I think my success is, perhaps, as uniform as anybody's. It is peculiarly fitted for filling root-canals, as it is very soft laterally and adapts itself readily to any irregularity in the canal, and is very firm when dried. I must say I am a little surprised at the success of driving gutta-percha up through a tooth. I should expect that it would make trouble. I never dared to fill a tooth with gold when I knew it was open at the apex.

The regular monthly meeting of the American Academy of Dental Science was held at the Boston Medical Library Association rooms, on Wednesday, January 6, 1892, at 7.30 P.M., President Brackett in the chair.

Dr. H. F. Hamilton read a paper entitled "Description of a Case of Regulating."

DESCRIPTION OF A CASE OF REGULATING.

BY DR. H. F. HAMILTON, BOSTON.

The case I present to-night is a common one, but the treatment is, I think, new. The patient, a boy of thirteen, had the condition of teeth shown in model marked No. 1, taken December 1, 1885. The lower jaw was receding, and the upper front teeth were so prominent as to prevent the easy closing of the lips, giving the face the weak expression characteristic of these cases.

Pulling in the upper front teeth would only improve the facial appearance slightly, so I determined to try throwing the whole lower jaw forward the diameter of a bicuspid. This I accomplished easily, so that in four months the condition was as shown in model No. 2.

You will understand what was done by noticing the articulation. In No. 1 the superior second bicuspid strikes in front of the inferior second bicuspid. In No. 2, you will notice, it strikes behind. The same change is, of course, shown with all the other bicuspids and molars.

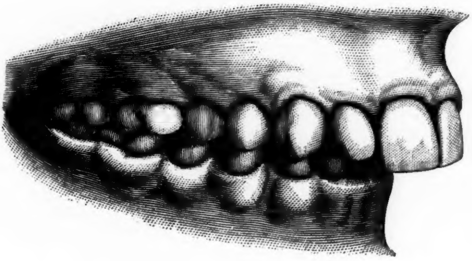
It was finished nearly six years ago, and I have watched it carefully before reporting. The teeth have not changed, and the wonderful improvement then shown in the boy's appearance has increased, the face being now strong rather than weak.

The method used was simply a rubber plate fitting the roof of the mouth and over the bicuspids and first molars, where it was made thick, and with depressions to receive the cusps of the lower teeth. But these depressions, instead of being directly over the cusps, were slightly in front, so as to throw the lower jaw forward when closed, by the action, as it were, of a series of inclined planes.

A plate was made also for the lower jaw on the same plan, and worn alternately to keep the teeth in place, and to avoid the injury likely to come from long and continuous wearing of plates.

At the end of four months the second molars, not being covered by the plates, had grown together so as to articulate when the plate

No. 1.



No. 2.

was in place, and the result of this change was that the patient could not close the teeth in the original manner. The changed position was the only comfortable one.

The plates were worn but little after this, nor were stay plates of any kind necessary.

This advance of the lower jaw comes, I think, from preventing the condyle going to its place; but there is a change going on at the angle of the jaw which will ultimately allow a perfect articulation.

This explanation is theoretical, and I should be glad of light on the subject.

DISCUSSION.

Dr. Meriam.—I would like to ask Dr. Hamilton whether the wisdom tooth erupted?

Dr. Hamilton.—Not until several years after the regulation was completed.

Dr. Meriam.—Was there much movement in the lower jaw? Was it possible for the patient to throw his jaw much forward?

Dr. Hamilton.—I should think he had rather less than the average movement.

Dr. Banfield.—Was the plate changed from time to time?

Dr. Hamilton.—Yes, the plate had to be changed, because it was rapidly worn away by the closing of the teeth. In four months' time I made three or four plates. At first I intended to make metal plates, or to put on the rubber plates metal caps, but I found that rubber was easier to shut into, so I let the patient wear out one plate and then made another.

Dr. Andrews.—How deep were the depressions on the plate?

Dr. Hamilton.—About an eighth of an inch; deep enough to get a firm hold on the occluding teeth.

Dr. Baker.—I should like to ask Dr. Hamilton if both of these plates were worn at the same time.

Dr. Hamilton.—No; they were worn alternately.

Dr. Clapp.—I understood Dr. Hamilton to say that the second molars were not covered with the plate, and after they had come into position the patient could not shut the mouth in the old way. I would like to ask if, before the plates were taken off, the second molars had come down in the way he designed that they should?

Dr. Hamilton.—They came on a line with the others; they all came together.

Dr. Clapp.—It seems to me that is one of the practical points of the case,—allowing the second molars to come into position.

Dr. Robinson.—Could you not have jumped these teeth far enough forward at one jump?

Dr. Hamilton.—No; I should not think it advisable.

Dr. E. G. Tucker then read a paper entitled, "History of Dentists who have graduated under Drs. Harwood and Tucker."

HISTORY OF DENTISTS WHO HAVE GRADUATED UNDER DRS. HARWOOD AND TUCKER.

BY DR. E. G. TUCKER.

Mr. President and Gentlemen,—It is sometimes pleasant to refer back to former times and persons. Perhaps it would be interesting to our young friends to learn what has transpired and originated from two individual dentists who were associated for many years as early as 1830,—Daniel Harwood, M.D., and Joshua Tucker, M.D. They were truly lovers of their profession, and desired to develop its progressiveness in all its liberal branches.

The following persons received from one or both of said doctors, in person, the principles of filling teeth with soft gold-foil and strictly hand-pressure. Each of the following dentists has left an honorable record in his different location: Dr. W. W. Couma, Boston; Dr. Blood, Worcester; Dr. S. B. Straw, Bangor; Dr. Hawes, Providence, R. I.; Dr. E. G. Tucker, Boston; Dr. Jos. H. Foster, New York; Dr. Eldridge Bacon, Portland; Dr. Horace Kimball, New York. Under the care of Joshua Tucker and E. G. Tucker were: Dr. Benj. Codman, Boston; Dr. Henry Jordon, Boston; Dr. Edward Gage, Paris; Dr. R. H. Gage, Mobile; and later, under the care of Dr. Joshua Tucker: Dr. Elisha T. Wilson, Taunton; Dr. Geo. T. Moffat, Boston; Dr. L. D. Shepard, Salem; Dr. E. P. Bradford, Boston.

I have simply enumerated facts without attempting to enlarge on individual attainments, which would take up too much of your time and are too well known to the profession to need any word of mine.

I would further state, that in 1830, the late Joshua Tucker brought from Cuba a receipt for mineral teeth, and with joint hands of the doctors and the perseverance and industry of the late W. W. Codman, M.D., in the laboratory, mineral teeth became a factor in mechanical dentistry.

DISCUSSION.

Dr. Meriam.—With regard to Dr. Tucker's paper, I want to say one word. I have said the same thing before, but I think perhaps it had better be in the presence of Dr. Tucker, and that is, that there must be among the archives of the Tuckers and the older dentists many of the earlier formulæ of dentistry, one of which he has referred to, and it seems to me that it is a good time to inaugurate a movement for the publishing of those formulæ, now that we have a journal that is willing to print interesting matter of this nature.

Dr. Baker.—Here is a tooth which is of interest; it was given to me by a lady about ten years ago, who told me that it was filled by Dr. Joshua Tucker forty years before that (*i.e.*, 1840). The man from whose mouth the tooth came has been dead about ten years, and it is such an old affair, I thought I would bring it here this evening.

REMARKS BY DR. CLAPP UPON COMBINATION FILLINGS.

The subject of combination fillings is one of great interest to me, and in looking over my records I find that the percentage of these in proportion to the whole number of fillings that I put in is very great. I believe that not one in ten realizes the practical utility of such fillings in the saving of teeth, and I doubt very much if one in twenty uses them to any great extent.

If the teeth are young or old, and of poor quality, to my mind it is much better to put in a combination filling of cement and gold than to fill entirely with gold. Of course, we have all been in the habit of lining up cavities with cements and filling them with gold afterwards. This is a practical and valuable method, and the principle may be extended very materially.

I have been in the habit for some time of putting cement into cavities, and, while the cement is soft, placing plastic gold right into it. By so doing, the gold of itself obtains the necessary retaining points; whereas, if you put the cement in and allow it to harden, then you must re-excavate and form undercuts to hold the gold. In crown cavities, for example, where the central portion of the tooth is largely decayed, but the overlapping enamel is still sufficiently strong to withstand the force of mastication, either amalgam or gold can be put in, and the surplus cement which is squeezed out by forcing the gold or amalgam into the cavity cut away. After waiting a minute or two for the cement to harden, the filling can be furnished with gold or amalgam, as the case may be. It seems to me that in many cases these fillings are better than if they were

made of one material. We find oftentimes in connection with a large cavity on the mesial surface of a molar, a small pin-head cavity in the distal surface of the adjoining bicuspid. My experience is, that if I fill these smaller cavities with gold, decay will reappear, and the fillings tumble out.

In such cases I often use tin and gold, a combination which you have heard advocated by Dr. Hamilton and Dr. Briggs, and which was spoken of many years ago in an article by Dr. Abbott, of Berlin. It is very serviceable in the crown cavities of sixth-year molars, also in buccal cavities, and in the temporary teeth. The statement which has been made here by Dr. Hamilton and others, that these fillings after a time become hard, something like an amalgam filling, is a fact, which I have demonstrated many times in my own practice. One advantage of the combination of tin and gold is that it does not discolor the teeth, as amalgam. As to the use of amalgam and gold, I know that my combination of these materials lasts longer than the all-gold fillings which I formerly inserted in similar cases. Oftentimes, in talking with dentists, I ask them if they use this combination, and they will say "yes," and then remark, "Do you use a matrix?" Thus showing that they have no idea of the proper manner of putting in such fillings, and, consequently, no idea of their value in saving teeth. To correct such false ideas is the reason for my appearing before you to-night.

The use of cement and gold in the front teeth is, to me, a very important affair. Without first putting in cement in the case of large cavities, or moderately large cavities in the poorer quality of teeth, I feel that the chances for permanent success are small. Cavities in frail teeth, where it is difficult to obtain a good retaining shape, can be filled with gold and cement, and the cement will assist very materially in retaining the filling.

In large cavities, if we can have a considerable proportion of the filling cement, we have a better filling, as there is less metal, and the cement will adapt itself better to the tooth than any other material. Here are specimens showing the method of putting in these fillings. This one shows a large approximal cavity in a molar. If a matrix is adjusted and cement placed in the cavity, and, while it is soft, amalgam inserted, the cement will be crowded down next to the matrix, and, consequently, the edges of the cavity will not be completely protected by a metal. To overcome this, I put in the cement before putting on the matrix; then add a little amalgam, thoroughly incorporating it with the cement; then trim

off around the cavity so that the edge towards the matrix is entirely exposed; then put on the matrix, and finish with amalgam or gold. In other cases I find it convenient to put on the matrix, and put a little amalgam next to it; then fill the body of the cavity with cement, and finish with amalgam or gold, or both, as the case may be. The large filling in the lateral incisor, which has been passed around for your inspection, and which, you will remember, is quite large,—restoring the contour of the distal portion of the tooth,—was made in the following manner: The cavity was prepared so that there was considerable undercut at the cervical wall; there was a very slight undercut towards the point. Cement was first put in; then plastic gold crowded into the cement; *but the gold did not go into any retaining point whatever.* After waiting a few minutes for the cement to become hard, the filling was finished with odd lots of gold that I picked up around the office, and with an extra hard blow of the automatic mallet. My idea was to see if the blow from the automatic mallet would break up the cement and prevent its being strong. Now, I want this filling tested. I may suffer a great disappointment to-night, because I don't know how strong the filling is, and it is possible that the gold may have no retention at all in the cement; but I do know that the mallet was put on very much harder than it would have been if the filling had been in the mouth, and the filling was very thoroughly finished with burnishes, plate-files, disks, and stones.

The tooth was then given to the President, who removed the filling with strong excavators, and stated that, in his opinion, it was more firmly held in place than would have been possible in such a cavity without the use of cement. After seeing the pressure it required to break out this filling, I think I should dare trust it in the mouth. Of course, in filling these cavities, you are laboring under unfavorable conditions.

DISCUSSION.

Dr. Ainsworth.—I would like to ask Dr. Clapp if the plastic gold was annealed before it was put into the cement.

Dr. Clapp.—If the bottle of plastic gold has been open any length of time, I usually anneal it; then put it into the cement, and crowd it in with a large instrument. A sufficient time must elapse for the cement to harden. After the cement has become a little hard, the plastic gold, inserted in one or more pieces, must be thoroughly consolidated with proper instruments. Then the

filling can be finished as though no cement was there at all, using either plastic gold or foil.

The cement that I have used for five or six years,—perhaps even longer than that, up to within about six months,—has been Weston's. I have used it with a great deal of satisfaction; but, just before the summer vacation, it became so unmanageable that I had to give it up.

I then got some of Dawson's cement, and have used that a little since; but in my hands it is not satisfactory. I think it is a pretty strong cement, and for lining up cavities it will do very well. Years ago, before trying Weston's, I used Fletcher's porcelain cement, which, it seems to me, was the best I ever used. That, after a time, became cranky, the liquid becoming hard so quickly, after a fresh bottle was opened, that I gave it up. This autumn, after having had an unfavorable experience with Weston's cement, I wrote to Dr. Lewis, of Buffalo, who is the American agent for Fletcher's filling-materials, and asked him if he had Fletcher's porcelain cement, and if it was in good working order. In reply, he sent me a package of it, and I find that it works the same as it used to, and it seems to me to be a very good cement. Some of its qualities are these: You can mix it very thin for crown-work, etc., and it will set very hard. It is a rather slow-setting cement, and you can use it very nicely, even after it is quite hard. It then works like dry amalgam, and with an oil-burnisher takes on a fine polish.

Dr. Mead.—I would make a suggestion with regard to cements: the powder, when of long standing, absorbs moisture which somewhat impairs its virtues. It can be restored to its original condition by heating in a porcelain dish over a sand-bath.

Dr. Clapp.—I would like to speak of another thing in regard to plastic gold, and that is its great value in commencing fillings. I cannot resist giving you one demonstration of that fact. Here is a cavity on the buccal side of a molar, and you know sometimes these cavities are very sensitive, and it is difficult to get much of a retaining point. This cavity was prepared with an inverted cone-bur, which was put in and run right around in the cavity. There is no angle whatever in it. The walls are nearly perpendicular; the cavity is a little larger inside than out. The way I start such a case as this is to take a good-sized piece of plastic gold,—I use Steurer's usually for this purpose,—and with a large instrument pack it in, using a smaller instrument to carefully condense the gold about the edges. If the gold is fresh, I do not anneal it; otherwise I do.

Dr. Ainsworth.—Do you use copal ether or anything of that kind before starting the filling?

Dr. Clapp.—Sometimes, and, theoretically, it is the correct way, but I don't always do it.

Dr. Ainsworth.—Did you ever notice any leaking when copal varnish had been used?

Dr. Clapp.—If it is used very thin, so thin that the preparation looks like water, it doesn't seem to me that there can be any trouble from that.

Dr. Parker.—Have you ever used Williams's plastic gold?

Dr. Clapp.—Yes, but I have never found any gold that has the quality that Steurer's has. And the special quality that makes this gold valuable in such cases is that when you put an instrument onto it, it is like pushing your finger into a snow ball; it only condenses that which is directly before it; but if you put your finger into a ball of cotton, it pulls a great deal along with it. This gold is absolutely without fibre; it condenses before your instrument, like soft snow. I use plastic gold for commencing nine out of ten of the fillings that I put in. I don't care whether there is more waste or not; if I can save five minutes' time, that pays for the waste gold.

Dr. Ainsworth.—Do you ever commence with foil?

Dr. Clapp.—That depends on where the filling is, and how I can get at it. For the particular point in the cavity that I am at work upon I use that which I think will best serve the purpose. I use the various forms of gold interchangeably.

Dr. Ainsworth.—Without any hesitancy in regard to cohesion?

Dr. Clapp.—Yes, I have had no trouble whatever on that score.

Dr. Eddy.—Have you ever noticed that certain foils adhere more readily than others?

Dr. Clapp.—I have not thought of that particularly. I use, mainly, Morgan and Hastings's semi-cohesive foil.

Dr. Potter.—Would you consider it good practice to complete the filling with plastic gold?

Dr. Clapp.—Certainly.

Dr. Payne.—Do you find that plastic gold will burnish as well as cylinders or foil?

Dr. Clapp.—It burnishes, I find, exactly as well. I think it harder than foil when finished.

Dr. Taft.—The subject of combination fillings is always one of interest to me, and I feel under great obligations to Dr. Clapp for what he has shown us to-night, much of which I shall put into practice.

My experience with compound fillings began at the time Steurer's

gold was introduced, and it has since that time been limited almost exclusively to amalgam and gold. Scarcely a day passes that I do not have occasion to insert one or more of these fillings, and I find them particularly valuable in large crown-cavities in molars, as well as in compound cavities when the matrix is used. After first making the cavity thoroughly antiseptic, my practice is to coat it with a very thin solution of sandarach varnish. By so doing the tubuli are closed, so that mercury is not expressed into them when force is applied to the amalgam, which should have as little surplus mercury as possible.

While I am not sure that compound fillings save teeth better than fillings made entirely with gold, I do know that this method saves time. In large crown-cavities in molars, for instance, where by other methods of insertion and finishing a filling will take an hour to perform, the time can easily be reduced by this method to ten or fifteen minutes.

My practice is to fill the cavity to within about an eighth of an inch of the top with amalgam; then carefully to work Steurer's gold into the amalgam, using broad points at first, then finer ones. I next use Watt's crystal gold, and finish the filling with foil or pellets. Thus we do away with all unnecessary undercuts, and reduce the time and fatigue of the operation to a minimum.

Dr. Meriam.—There is one filling which ought not to be lost sight of. It was introduced by a dentist of Brooklyn, N. Y., and consists of cement to which an alloy has been added. The durability of the cement is thus increased. Dr. Howe has given it as his opinion that there is something more than a mechanical union existing between the cement and alloy; there seems to be a chemical union, and the result is a greater resisting power against solution.

We have never failed in the mechanical work of filling; we can make our fillings stay in; we can make amalgam stick to gold, or gold stick to amalgam, and still be no further advanced than we were before, unless we impart to them a therapeutic action, or in some way prevent the edges of amalgam fillings from standing away from the teeth. With tin, on the other hand, which possesses therapeutic value, I have not known of a case where there has been this trouble. It is a material that can be nicely burnished, and is so soft that it adapts itself well to the edges and remains there; and while the tin itself may discolor, its stain is so little that it seems preferable to the union of gold and amalgam. The union between tin and gold may not be as strong as that between gold and amal-

gam, yet it is sufficiently strong for the purposes for which it is used.

Dr. Banfield.—Does Dr. Clapp have any preference in regard to the kind of amalgam he uses?

Dr. Clapp.—I have for five or six years used almost excusively Caulk's white alloy. It has proved itself better than any previously used. It works perfectly well as far as the union with gold is concerned; in fact, I have had no trouble in that respect with any amalgam.

In regard to the use of amalgam and gold in crown-cavities, as spoken of by Dr. Taft, I never use it in that way, for this reason: I consider cement, where it is entirely covered with gold, far preferable to amalgam. To me, there is an objection to a large amount of metal in a tooth; but the larger the core of cement the better the filling, to my mind. In large cavities, where there is an immense amount of amalgam and gold, there must, I believe, be some change of size due to thermal variations. This change in the size of a large metal filling may crack a frail tooth; therefore, I lay it down as a principle to put just as little metal as possible into a tooth, and still have enough for strength.

In regard to the amalgam creeping or crawling away from the edges, I have never seen it happen in the combination fillings of gold and amalgam such as I have described. Of course, I have seen many such cases where the filling was entirely amalgam. In one or two only have I seen decay reappear about my gold and amalgam fillings. I feel very much more confident of such fillings than I do of those made exclusively of either of these materials.

I thoroughly believe in using tin and gold. I often use these materials at the cervical margins in preference to amalgam.

Dr. Banfield.—I have used for a great many years what is called "Standard Alloy." It has given me better satisfaction than any other. I have recently seen some large fillings in molars extending from the crown to the approximal surface, and including some of the cusps. These fillings were made several years ago of "Standard Alloy," and are now in good condition; the edges perfect, and teeth well preserved.

Dr. Taft.—Since I have entirely discarded the use of silver alloys my combination fillings have been made with gold and copper amalgam. The result of my experience and observation with regard to silver alloy leads me to consider it the least desirable filling material that can be used.

Dr. Banfield.—Has Dr. Taft noticed any disintegration in his copper fillings? I understand that a number of dentists who have used copper amalgam have become disgusted with it, and have taken out all fillings made with that material.

Dr. Taft.—Occasionally I have found the disintegration mentioned, but it has almost always occurred in mouths where the secretions were of an acid nature, and where cement or gutta-percha fillings dissolve away very rapidly. The proportion, however, of cases where the fillings show disintegration or become cup-shaped is so small that I do not regard that objection as of any importance. If any of you have had occasion to take out copper-amalgam fillings, you will have noticed how much more dense they are than silver-amalgam fillings. Copper amalgam is used with very great advantage in cases of white decay, occurring on the buccal surfaces of molars. If such cavities are filled with copper amalgam, a hardening rather than a continued softening takes place. When the patient presents himself at a later day you do not find a leaky filling, as very often happens when a silver alloy has been used.

Almost all of the silver alloys, to a greater or less extent, have the disagreeable characteristic of bulging out or shrinking away from the margins of the cavity, and I have become thoroughly disgusted with them, and have entirely discarded their use.

Dr. Banfield.—As I understand it, white decay is found in mouths having an acid reaction. Are not these mouths, then, really the most unfavorable for copper amalgam?

Dr. Taft.—I certainly do not think so. If I had found such to be the case I should have discarded copper amalgam altogether. I can only speak from my own observations. Where copper-amalgam fillings show a cup-shaped appearance, I attribute it more to the fact that the amalgam has not been put in as dry as it should have been, or else that it has been put in under moisture, and a part of it has come away after the completion of the operation.

Dr. Baker.—I would like to ask Dr. Clapp if he uses his gold and amalgam fillings in cuspids,—say the distal surface, or the mesial surface of the first bicuspid?

Dr. Clapp.—I often use it in the mesial surface of bicuspids. I don't remember that I have ever used it in a cuspid. If I use it in the mesial surface of a bicuspid, I put it in so that it will not show on the labial side, filling the whole of the buccal or labial wall with gold, so that there may be no discoloration. I have used to some extent a preparation, by Williams, of platinum and gold. It is a platinum foil on which gold has been deposited, and I oftentimes

put a piece of this against the wall, and then pack amalgam against it. I have not, however, used it sufficiently to know whether it will be an absolute protection against discoloration. But, if amalgam is likely to show at the cervical portion of the cavity, I only put it part way, and fill the exposed portion with gold.

Dr. Baker.—As a matter of fact, then, amalgam invariably discolors, and the dentine is stained unless the cavity is lined with some other material.

Dr. Clapp.—All teeth are not discolored, but some are. I think the quality of the tooth has something to do with it; but it certainly discolors teeth to some extent, and for that reason one must use his ingenuity.

Dr. Eames.—For the past twelve years, since Dr. Kingsley spoke of using gold and amalgam together, I have followed his method, and have first filled with amalgam, and after it has hardened, removed a certain amount of it and completed the filling with gold. By this method I am able to control the shape of the filling as well as the amount of space which the amalgam is to occupy in the cavity. I am quite sure that when gold is placed in connection with amalgam, even though that has been in position two or three days, it controls subsequent changes in the amalgam. Such fillings do not crumble at the edges, or show the characteristic failures of pure amalgam. In very frail teeth I have allowed it to harden for the strength it would give, and then put in gold. At times, however, I use gold and amalgam, as Dr. Clapp has described; and join with others in thanking him for the admirable talk he has given us on this subject.

Dr. Clapp.—I have used copper amalgam a very few times. So far as I know, none of the fillings have dissolved out to any great extent; but they have become of such inky blackness, and the tooth itself has become permeated with the stain to an extent that I have never experienced in connection with the silver alloys.

Dr. Taft.—It is curious how experiences differ in regard to the use of different materials. Meeting Professor Putnam, of the Peabody Museum of Archæology, at Cambridge, one day, in the course of our conversation the subject of copper-amalgam fillings came up, and I remarked how much satisfaction and success I had in the use of it in the saving of teeth; and to what an extent it was being used by many others in our profession. He replied that he could very easily understand why this was so, as he had always found, in exhuming the bones or skeletons of the ancient mound-

builders, "that wherever the bones had lain either in direct contact with or even near deposits of copper, they were in a perfect state of preservation." This shows that the salts of copper do have a very decided preservative effect on bone-tissue.

Dr. Hamilton.—Here are some little books that I have made for records, in connection with the ordinary examination-cards. They are of the same size as the cards, and have a page for each tooth. I put down special memoranda, and find it extremely useful in referring to the previous condition of the tooth in cases of special treatment.

Dr. Banfield.—I hold in my hand two mandrils, that are the best I have ever used for holding sand-paper disks.

They are made by the Claflin Dental Manufacturing Company, of Worcester. They have two points of advantage,—first, the screw-head and its adjacent parts are made very thin, allowing the disk to be carried far up between the teeth. Secondly, the screw-head is made so that only the circumference touches the disks, and by this means such a firm hold is obtained that there is no slipping when turned to the right.

The regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms on February 3, 1892, President Brackett in the chair.

The paper of the evening was read by Thomas Stellwagen, M.D., D.D.S., of Philadelphia; subject, "The Teeth and the Feet."

THE TEETH AND THE FEET.

BY THOMAS C. STELLWAGEN, M.D., D.D.S.[1]

The possibility of any practical connection between the teeth and the feet, up to the present time, does not appear to have attracted the attention of dentists in proportion to the importance that the gravity of the consideration demands. The guidance of fond parents in their responsible and delightful duties, the interest that they feel in the rearing and the welfare of their growing children, the aim and desire that their offspring should all be paragons of perfection and beauty, both physically and mentally, make the subject one of nearly universal interest.

The neglect of the correlation of these organs may be due to their remote separation in the human structure, being such as to divorce them from simultaneous study. Likewise it may be, in no small degree, the outcome of what may be denominated the fashionable drift of thought that diverts the general public from observation of the feet; except in the small class made by the dancing-masters and foot-ball team captains.

Among the disadvantages of so-called modern progress, some of the most useful tradespeople are to be seen within their shops, neglected in the onrush. Fear may be expressed lest the hurry of the nineteenth century has resulted in stamping out of existence the true shoemaker and substituting in his stead the great shoe-factories. The modern luxuries of carriages and palace railway cars, of bicycles and tricycles, with their wonderful records of great distances traversed within enormously diminished periods of time, combine to revolutionize the use of the feet as means of and organs for propulsion. These causes operate in diverting the thoughts from the humble but wonderful locomotors; in effect, relegating them from the great practical purposes of life to the degrading duty of displaying costly adornments that deplete the purse and cripple the self-supporting powers of the wearers. We should draw a lesson

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from the famous battle of Larissa[1] in Thessaly, about the year 988, when Bohemond, leader of the Normans against the Greeks, was defeated by the latter aiming their shafts to kill the horses, thus making the dismounted riders easy victims with their unwieldy boots with toes two feet long, patterned after the form of scorpions. The tide of battle may be said to have turned upon the toes and heels of the Norman boots. Rarely has history more directly acknowledged the great importance of proper footwear. The deeds enacted by the feet upon the battle-fields were wonderful, where there hung in the balance such momentous affairs as revolutionized the thoughts and creeds of men, the very foundations of religious beliefs and moral enactments. By a stretch of imagination, the great and rapid marches of the German armies in the Franco-Prussian War, by inference somewhat distant and possible, may be accepted as an admission, although concealed from direct mention, that these troops must have been possessed of wonderfully good and useful feet.

Lest this thesis may be criticised for squandering too much of your valuable time, and paying too great tribute to the orthopedist's or chiropodist's functions rather than the odontologist's, it may be now asserted that the importance of the knowledge of how to properly care for the feet, as the basis of the whole bodily structure, will most profitably repay the specialists as well as the general practitioners of the healing art.

In the present era of science it is recognized by all who think of the philosophy of life-action that an ample supply of oxygen to each and every part of the living body is essential. By it the building of tissue, the storing and elimination of energy are brought about; upon it depends the no less practical functions for facilitating the economic removal and healthful disposal of the matters that otherwise would promptly become objectionable, effete, and often both harmful and dangerously threatening to life.

The micro-organic materials that in many diseases are abundant in the tissues of the body are now conceded to be most promptly and satisfactorily checked in their growth, formation, and multiplication by a luxuriant supply of vivifying and combining element, oxygen. The eradication of disease by destruction of the pathogenic microbes or their poisonous products and the abnormal cells of the tissues, the transformation of the multiform pathological germ-causes of sickness into harmless growths, are best performed

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[1] Gibbon, vol. v. p. 474.

and probably are only capable of accomplishment by the stimulation of the tissue-cells to their highest possible beneficial activities. These desirable changes are known to be responsive to such physical conditions as encourage and invite the lively mutation of combinations of the elements in the constructions and destructions of cell-substances, in obedience to the all-pervading laws of chemical affinity. The higher forms of life are well known to flourish when furnished with enormous quantities and constant supplies of this gas, for completion and perfection of the metabolic transitions that are as intrinsically necessary to the perfection of each cell as the whole body is dependent upon its individual parts for its composition and integrity.

That the microbes are the sole and entire cause of all pathological phenomena, and are to be held as entirely blamable for each and every disease, has been modified in many ways by others, who, if not more deep, are at least more recent thinkers. The ptomaines that are formed by these wicked and idle microbes, and the schizomycetes, with their iconoclastic or catabolic and destroying propensities, are set down as the principal evil influences. Other students of these phenomena of death and destruction liken them to thieving mobs that run riot through the communities of the legitimate citizen-cells and filch from the latter their hard-earned oxygen. The conditions of the tissues that permit the formation of the nests for these pernicious growths are impossible when healthy nourishment is the rule. From all sides the conclusion is forced upon us that when the natural and lavish supply of this important element is maintained in and throughout the remotest tissues, the symptoms and serious effects of most diseases are either in great part mitigated or entirely banished from those parts of the economy of nature.

In the light of modern scientific investigation, the various tubercular and glandular swellings that are pathognomonic of the scrofulous diathesis are produced by the caseation of matters, which, under strictly physiological operation of the anabolic and catabolic cell-changes, should have been cast out in the forms of the natural excretas by the proper depurative organs. The respiratory, renal, and dermal systems, and the lower portion of the alimentary canal furnish the principal parts of the complicated and as yet only partially understood apparatuses that are charged with the very important duty of elimination of the excretory matters from the blood. This is most perfectly and economically performed after each nutritive, component, proximate principle has by combustion

set free at least the major part of the energies that were stored up in the processes of cell formation and growth. The natural energy, that is latent in the various organs, at proper time exhibits itself by the phenomena of their functional action. In these changes oxygen plays the chief rôle.

Failure to remove by these means of depuration the worn-out matter accumulated in the blood or the tissues is productive of disease. Even partial retentions and obstructions by these fecal matters in the alimentary canal are demonstrated often to be the precursory state that may be followed by a process of reabsorption and redistribution. The merest tyro in the healing art knows the dangers following these neglected duties that permit retention of matter that is more or less pernicious or violently poisonous. These products exert injurious influences and powers upon the tissues and cells that are bathed in them or assimilate them. By transmissions and harborings of these deleterious excretas in many tissues, the whole system is affected both directly and indirectly. Increase of the scavenger work to be accomplished in the communities of cells reduces the efficiency and the number of employés of the department of what might be compared to the public board of health in the commonwealth of the body.

The result of arrestation of the processes of digestion and absorption, even of healthy food, frequently is speedily followed by decomposition. Such degeneration of food-substances is most prompt at the temperature of the human body. This breaking down of the chemical compounds of the matters in the stomach and alimentary canal liberates gases that may in their turn be accountable for the painful sensations of distention of the containing portions of the digestive apparatus. The unnatural impingement and undue pressure upon their surroundings, together with the vast and unruly train of dyspeptic symptoms, follow. After centuries of suffering by untold millions of unfortunates, and expenditures of many more millions of money, in vain and often even unimaginable ways of research and attempt to discover a drug or remedy for the cure of this disease, the quest has been almost entirely unsuccessful. Like most human difficulties, it has been a simple, blind, and stupid one, raised by men's perverse disposition and stubborn persistence in the disregard and disobedience of the axiom of the divine command, "In the sweat of thy face shalt thou eat bread." (Genesis iii. 19.)

Physical labor, in a large majority of instances, is remarkably dependent upon the perfection of the adaptation of the feet to their

very important and valuable purpose of serving as the foundations upon which the whole body is supported. The most superficial reference to architecture or construction will acquaint us with the rule that the perfection of a building, or superstructure, mainly depends upon the correctness of its foundation, in its adaptation to the support of its load.

The growth and development of the child is largely in proportion to the utility of its feet, and their capability of sustaining the various shocks and strains put upon them, which duty they should accomplish without undue fatigue or suffering. The passion young animals show for change of location, that is familiar to any who have noted the restlessness of children and that so frequently harasses and annoys the more elderly and sedate nurses or attendants, is but the natural outcome of the conservation and expenditure of nerve-force that, by its indulgence and exercise, stirs the muscular tissue to functional action, which is a powerful and natural cause of the healthful stimulation of the circulation of the blood. This, by reason of the wear and tear induced by use, causes an extra but not abnormal demand upon the digestive apparatus. In a word, it calls into play the various organs whose functions, when properly combined, only give forth harmonious interworking, and result in well-balanced development and growth.

No more thoroughly-accepted proposition can be quoted than that the restraint of the motions of young animals before they have attained their adult size and functions will cause them to be undersized, dwarfed, and often diseased and malformed. Observe the demonstration of this induction everywhere, and in all living voluntary moving beings. See how it is illustrated in the deficient hind limbs of large dogs that have been reared in close and confined quarters. This is shown where puppies have been kept chained to prevent them from injuring and destroying other animals or the surroundings of the houses, and disturbance of the households of their masters. An unnaturally peaked or pointed and elongated muzzle is found on such dogs, that may justly be said to speak louder than words, showing the corresponding lack of strength and breadth of both the maxillæ and their attached muscles.

Why go further than our daily experiences as dental practitioners for illustrations of these associations of causes and effects? Who are the children that we are obliged to treat for dental and oral irregularities? Do the unrestrained and healthy country-bred, barefooted urchins apply for the expanding apparatus for their dental arches? Is it not almost entirely prevalent among the miserable,

dyspeptic, cramped, and tender-footed children who are unfortunate in the possession of parents and guardians, who have long been out of the line of common sense, and who are accustomed to outweigh the blessings of health and strength, by the morbid concern they evince for fashion and her proprieties? Does not the coveting of what is falsely termed social position make such rebels against children's rights persuade themselves that it is a true kindness to squeeze out of all semblance of shapely usefulness the soft and readily-mouldable cartilaginous bones, under the silly pretext of protecting their innocents from harm, and cold, and injury? The modern shoes seem especially designed and constructed with greatest ingenuity to antagonize the growth, the elasticity, the mobility, and the strength of the wearer's feet. By breaking down the arches, these devices deform, hopelessly cripple the toes, and cause painful corns, bunions, and other abnormities of growth. The circulation of the blood, the nourishment of the tissues, the resistance to cold, the power of nutrition in general, are these not all impaired by the shoes of the civilized child? Can we longer look on such cruelty practised in the name of humanity and parental love without loss of patience and raising our voices to abate the evil? Alas, we cannot stop here, the ankles are bound so tightly as to almost produce anchylosis; their functions are almost obliterated for these little sufferers. Not content with cruelty to the feet alone, now fashion aims to destroy the whole leg and even the knees. Little Lord Fauntleroy has cursed his poor imitators with leathern gaiters, stiff and awkward, heavy and tiresome. Oh, mothers put on balls and chains, out-Herod the Celestials, afflict your boys as well as your girls,—go beyond China!

Need it be asked, How can such a bestocked, hampered, weary, exhausted child develop and enlarge his lungs, have an appetite for bone- or muscle-making food that the very force required for its mastication will spread the alveolar processes, and produce healthful nutrition and growth of the mouth and its associated systems of glands, of muscles, of bones, of mucous membrane, of teeth?

The desperate criminal galley-slave can carry his ball and chain in his hand. The thief in the stocks is not doomed for all day and every day in the week. Both of these have attained their full growth and will not be made sickly and dwarfed. In what have these children so sinned that they must suffer such refinement of torture, as causes one to shudder at the thought of its being applied lightly and gently to the worst and lowest classes of men exclusively? Are the children thus prevented from giving you and

their attendants trouble by the noise and clattering of their feet, and by occasionally escaping while nurse is ogled by a policeman?

Be consistent, arm your children's keepers with guns, tell them to shoot, to kill, if the little ones cross the dead-line; but in the name of all that is healthy and good, let them be at liberty within their play-grounds. Let them have at least as fair opportunities in their struggles with death, diphtheria, and denticulariæ, as the little urchin of the back alleys, who laugh at your pity for them in their bare feet, and take delight and pride in their designation "kid."

The practical side of this question for the orthodontist and the general odontologist should be to invite attention to the general system beginning at the feet as the foundation, and observe their adaptation to their work. If they or any portion of the locomotor apparatus are defective, it will greatly assist in the treatment of the mouth and of the teeth, if the part or parts of the body or limbs at fault be improved or corrected. Nature will be one of the most powerful means we can employ, even if only as an ally, in the stimulation of growth of the jaws. By proper exercise the appetite for suitable food will be begotten, and resulting from this will be practice in the use of the jaws in mastication. Then will awaken the dormant constructive action, and growth will be renewed.

The aim of this discourse is to emphasize a plea for the replacement of the morbid by healthy processes. It furthermore seems to be a proper question whether the very ingenious and complicated apparatus within the mouth, used for orthomorphia, has not cultivated too much reliance upon mechanical and too little regard for the natural means of correction. The presence of the apparatus for moving the teeth does not improve their masticatory functions, and although the expansion of the arches may be effected, still it might be assisted and hastened by the benefit derived from natural work. If the blood-flow be increased, nutrition of the bony support certainly will be a sequence of this functional activity. Chewing or biting upon a piece of hard wood, as recommended by the late Professor McQuillen, has often done more to expand arches and symmetrically arrange the teeth than whole drawers full of apparatus to be worn in the mouth and worked by springs, screws, and wedges. The flow of saliva that follows upon thought of sapid substances indicates the glandular action which results from a determination of the nutritive current to these parts, and is an illustration of the manner in which the control of secre-

tions and growths are under nervous influences. Deprivation of pabulum to any part is quickly followed by sloughing. Diminution of the supply will result in proportionate arrestation of growth or development. If the lungs, the arms, the legs, or any portion of the economy is defective in size or texture, the most likely method of effecting repair of growth comes through judicious motion and increased use. Why then will not a law so universal act for the benefit of the jaws? If this be true, will not such exercise as provokes healthy desire for food of the kind qualified to build up and replace the consumed and worn-out tissues react upon the jaws through the increase of their nerves and blood-currents?

Some observations that your essayist has made upon those afflicted with crippled and clubbed feet seem to point in this direction; for, if the cases viewed, are not by some remarkable series of chances very exceptional, the crippling of the feet in an undue number of cases is accompanied or more likely followed by the deformity of the dental arches. Indeed, a curious confirmation of the proposition may be mentioned, that in a great many of the exceptions to the association of dental abnormities with impaired power of the feet, there were discovered to be well-marked vicarious auxiliaries for locomotion in strong hands and arms to wield canes and crutches.

The following table shows the proportion of regular and irregular mouths among a series of children having crippled or deformed feet.

Boys. (*Over eight years.*)

Regular	2
Slightly irregular	8
Irregular	7
Very irregular	7
Total	24

Boys. (*Eight years and under.*)

Regular	5
Slightly irregular	6
Irregular	1
Total	12

Girls. (*Over eight years.*)

Regular[1]	8
Slightly irregular	6
Irregular	8
Total	22

Girls. (*Eight years and under.*)

Regular	2
Slightly irregular	2
Irregular	2
Total	6

[1] One walked until thirteen years of age. One crippled at ten years of age. A few cases have been seen since reading the paper and are included above.

DISCUSSION.

Dr. Stellwagen.—In examination of patients at Orthopædic Hospitals, in nearly every case where the dental irregularity was slight or entirely absent the children had, to a great extent, supplemented by their hands the use of their feet, and thus their mouths were kept in a tolerably healthful condition.

A study of a series of heads showing the development of the teeth demonstrates that at the age of the eruption of the permanent teeth the jaws increase very materially. Hence at this period it is of the utmost importance that the maxillæ should be exercised.

In the list of cases examined there were twenty-four boys and twenty-two girls. Among the boys there were fifteen irregular cases requiring operation for regulating the teeth, some of these also requiring an expansion of the jaw. Of the very irregular cases, there were seven requiring operations both to straighten the teeth and to expand the arch. In twenty-two cases of girls, eight normal cases were found. Six were slightly irregular, eight decidedly irregular.

The cases examined were nearly all in hospitals, and the average age eleven or twelve years.

Dr. Williams.—A long time ago the remark was made in one of our best books, "Let not the hand say unto the foot, I have no need of thee," and although that is not the title of Professor Stellwagen's paper, his application of that idea is founded on solid principles.

Another point, too, that struck me in his address was the fact that a corn on the toes or a pinching boot will take away one's appetite, and I can see how, if the irritation exists sufficiently long, a discomfort of this kind would create malnutrition, and its consequent effects would be apt to show themselves quite as much in the teeth as in any other part of the body.

Dr. Eames.—This paper is a strong argument that the dentist be medically educated, in order to better understand the significance of the relations existing between different parts of the body.

From the better medical education of the dentist may come important light upon the subjects of erosion, phagedenic pericementitis, and stomatitis.

Dr. Barker.—Professor Stellwagen's paper is a new statement of the old fact that function determines form. The moral contained in the paper might well be applied to many of our school-children,

whose time is so largely occupied in the translation of Latin and the study of Greek roots that they neglect physical development. Parents who have young children should turn them out to pasture, treat them like colts.

Dr. Stellwagen.—My opinion is that the foot should be covered with something more like a moccasin than a shoe, and that children should be allowed to run barefooted as much as possible.

The benefits derived from this practice were demonstrated last summer during a six weeks' sojourn at the sea-shore. Two of our youngest children were allowed to walk and run in the sand without shoes or stockings. The result was that the boy, who is now thirteen, increased in chest girth from sixty to seventy centimetres, with the power of expanding the chest to eighty; so that he really increased his measurement from one-sixth to one-third.

His limbs also were materially changed, the muscles were firmer and more solid, and his foot increased about a size and a half. Would it not be better for children if barefooted exercise were substituted for the use of donkeys and many other means of amusement? Would we not have a better development and a firmer condition of the teeth and jaws as well as of all other parts of the body.

THE regular monthly meeting of the American Academy of Dental Science was held at the Boston Medical Library Association rooms on Wednesday, March 2, 1892, at 7.30 P.M., President Brackett in the chair.

The paper of the evening was by Dr. Louis Jack. Subject, "The Fixation of Dental Matrices and the Packing of the Cervical Portion of the Cavities."

THE FIXATION OF DENTAL MATRICES AND THE PACKING OF GOLD AT THE CERVICAL PORTION OF THE CAVITIES.

BY DR. LOUIS JACK, PHILADELPHIA.

The consideration of these important features connected with the use of dental matrices is entertained for the reason that the difficulties which have usually been encountered have generally pertained to these two procedures.

The general purposes of the matrix are to make less difficult the formation of the proper contour of proximate surfaces, to effect the placement of the gold in exact adaptation to the cervical wall with sufficient solidity, and to secure these ends without injury to the structure of the teeth.

This appliance greatly facilitates the packing of cavities on the distal proximate surfaces of molars and bicuspids, for which surface it is more especially intended as being particularly well adapted to these positions.

With the increased deftness which grows out of experience with this aid, it becomes frequently an important assistance to the performance of many mesial proximate cavities.

It is not necessary to dwell upon the details of the preparation of the carious cavity. Let it suffice to state that when the cavity is situated on the distal proximate surface of the molars, the opening of the orifice should include a large portion of the masticating plate of enamel; that the walls should be undercut at the inner and outer margins, so far as may be done without weakening the strength of the borders; that it is not necessary the undercutting should extend entirely to the cervical margin; that the cervical wall should be transverse to the axis of the tooth and be formed without undercuts or retaining pits; that the margins at all points should be countersunk, but to a much less degree at the cervix than at the lateral margins. It is also important the margins of

the cavity be polished to facilitate the movement of the gold by the removal of the friction. When the cavities are situated nearer the front of the mouth, the removal of the masticating wall becomes only so far necessary as to facilitate the introduction of the gold and to eliminate so much of this plate as may be subject to impairment by the force of mastication.

For the ordinary cases of teeth which are not impaired by fracture or by the loss of structure by previous extensive cutting, the forms of matrices which I use are the depressed and those of plane surfaces bent and formed to meet the exigencies of the case in hand.

Where the depressed form is used the depression should correspond in size to the dimensions of the cavity, and its edge should extend a short distance above the cervical margin. This form of matrix is better adapted when the margins of the cavity have been so far weakened by carious action as to necessitate trimming away a portion of the buccal wall, and where for reasons beyond control the teeth are considerably separated.

The plain matrix is better adapted when the separation between the teeth is slight. It should be stated that in all cases it is necessary for the securement of correct results that the preliminary step in each case should be the separation of the teeth by pressure; this is to enable the parts to be properly finished, and to have the gold of the one tooth come into contact with the gold of the adjoining tooth at the natural points of contact of the proximate surfaces of the teeth. These preliminaries enable the consideration to be made of the fixation of the selected matrix.

The important requirements concerning this procedure are that the matrix shall be in contact with the cervical surface of the tooth as nearly throughout that margin as it is possible to have it; that the matrix shall be in contact with the lingual margin of the cavity, and be in near contact with the palatal margin below the cervical portion.[1] This feature of the fixation of the dental matrix is at some difference with the views of some others concerning this point, but I hold that to impact the gold by the percussive force necessary to produce contact and solidity at the cervical border the line of junction should be a close one. This hypothesis has been borne out by considerable experience with the two conditions of

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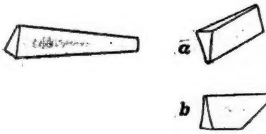
[1] In using the words "above" and "below" in relation to the cavity, the tooth is considered out of its topographical position, the apex being considered above and the corona below.

proximity and apparent contact. The securement of contact at these two points of the margin is attained by the peculiar form of the wedges to be used. The one for the cervical border is a double wedge. The sectional dimensions depend upon the space at the cervix and somewhat upon the general area of the cavity, and its length upon the lateral size of the tooth. This wedge, after being dipped in Sandarac varnish of the consistency of syrup (any excess of the varnish being removed), is forced into the space by pressure. If of proper size it should appear at the inner margin, and extend beyond the outer surface far enough to allow a grasp to be made for the removal. The wedge for the palatal margin is also somewhat of double wedged form, but it is not sharp at the point.

At *a* (Fig. 1) the piece appears as a simple double wedge having an even width, but becoming thinner on the back at the end, to be applied at the cervix. At *b* the end is cut in the form presented. It should be of size to correspond to the space between the matrix and the tooth adjacent to the subject of the operation. When the tooth is much rounded the face of the wedge often requires to be hollowed out with a gouge, the better to adapt it to the space. This wedge is varnished, put in place, and forced into position by an instrument pushed against its thick edge at the upper part. The object of the mitre-like form at the end now appears, as this surface corresponds to the line of the cervix. In some cases this end will be apposed against the cervical wedge; in other cases it will pass between the adjacent tooth and the cervical wedge. In either case it makes this portion of the matrix secure and permits the contour to be effected.

Fig. 1.



It may appear a small matter to dwell with so much detail upon so apparently trifling a matter as a wedge for this purpose, and yet it is upon the absence of definite knowledge of a correctly mechanical fixation of the matrix that has prevented many operators from securing the great benefits which are to be found in the employment of matrices. It is, I believe, the absence of the thoughtful application of these simple means which has led to the invention of complicated and, I believe, less effective methods for fixation. It will be perceived by the accompanying casts the adaptation of this method to which attention is directed.

THE FILLING OF THE CERVICAL PORTION.

The chief elements connected with this feature of the subject concern the character of the gold, the form of the pieces of gold, the form of the instruments best adapted, and the method of applying the instruments. Each of these considerations is important, and a disregard of the qualifications of the filling material or of any of the essential procedures may defeat the ends to be secured by this system of filling cavities.

The gold to be employed for the upper half at least of the space should be non-cohesive and soft; that is, it should be incapable of being rendered cohesive by heat, and should remain soft and lead-like during the manipulation to which it is subjected. The gold I have found to fulfil this requirement more nearly than any others which I have used is the so-called soft gold of Morgan & Hastings. The soft gold of Abbey & Sons is also well adapted, but each one should make his own tests of the quality in this respect of the gold to be used.

The reason that gold of a cohesive nature should not be employed is that the portion in immediate or close relation to the instrument may become consolidated and bridge before the point in such a manner as not to permit the force to be expended to the ultimate portion of each piece of gold which is being moulded into position and undergoing consolidation.

THE FORM OF THE PIECES.

That form which will be found best adapted in the larger cavities is produced by folding a tape into a block. The tape is formed by folding from one-third to a whole sheet of No. 4 or No. 5 three times, thus producing a tape of eight layers. The division of the sheet is dependent upon the dimensions of the space and somewhat by the strength of the walls. The folding of the tape into blocks is also, as to form and number of turns made, dependent again upon the size of the cavity. These variations can only be learned by the study and experiment which each one should make for his own guidance, and for which no theoretic rule can be defined.

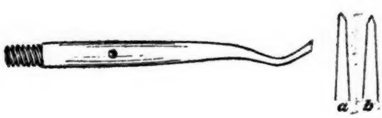
THE FORM OF THE INSTRUMENTS.

It is obvious the shape of the plugging instruments to be used in this system of stopping cavities must be different from those which are applicable to the ordinary methods. The bends of the

shank should be such that the points may reach all parts of the cavity, and the form of the ultimate point is required to be that which will be best calculated to produce adaptation and solidity of the gold at the lines of apposition of the matrix and the walls of the cavity, and also should be so shaped that by slight rotation of the instrument on its axis the point may reach into the retaining grooves, to carry on the consolidation of the gold at this point.

Fig. 2 represents the shape which I have found to be more nearly universal for this purpose than any others, and, as will be seen, differs only in the form of the ultimate point first described and published as a matrix plugger.

Fig. 2.



It will be observed the ultimate point is not flat and transverse to the axis, but that it is ovoid and slightly bevelled to give the extreme edge a little to one side. This necessitates the points to be in pairs, but for the general packing the points are transverse laterally and slightly ovoid. In the use of the instruments the edge is held at an angle to the marginal line, to prevent the point being driven between the matrix and the margin of the cavity; by this caution and slight tilting movements deft use of the instrument is quickly acquired.

When these are made of several sizes and of slightly varying bends they will meet the requirements of any case which may occur. The serrations are made very fine, and are necessary only to inhibit the instrument cutting the foil and to maintain a frosted surface, which prevents too easy sliding of the gold.

THE PACKING OF THE CERVICAL PART OF THE SPACE.

The chief ends in view in the use of matrices are the facilitation of the procedure of packing the gold and the perfect adaptation of the gold to the cervical wall. The difficulties attending the adaptation of gold-foil to the cervical walls of distal cavities, as applied in the ordinary methods, are caused partly by the posterior position, and partly by the physical tendency of gold to draw away from the margins during the packing process. This tendency pertains to all forms and kinds of gold used. When the cases are upon accessible surfaces this disposition is overcome by leverage movements of the filling instruments, and by the employment of foot points. On the distal surfaces, when the spaces are compara-

tively small, the opportunity for leverage does not exist, and the foot point is not convenient of application.

There is another important advantage this method possesses. When distal cavities are filled by the ordinary plans, it is necessary either to produce deep retaining grooves near the cervical region or to make retaining pits at this part. Each of these have serious objections; the first weakens the lateral walls, and the latter impairs the vitality of the adjacent portion of dentine, and also in many instances imperils the safety of the pulp. These deep retaining means are then necessary to insure that degree of securement of the first pieces of gold as to permit the malleting with the foot points to bring about adaptation without causing displacement of the gold. As before stated, the retention when the matrix is used need not be by undercutting at the upper part of the lateral walls.

When all is in readiness, a block of the gold is seized in the pliers and carried towards either cervical lateral position in such manner as to direct its end towards the countersink. It is then secured by the use of any suitable plugger which will fix it in position. The opposite aspect of the cavity is treated in the same manner when the special pluggers are used to force by percussion the blocks into adaptation with the margins. A third piece is next adjusted between the two. When this is fixed in position careful adaptation may be effected by going over the whole surface, particular attention being directed to secure contact along the line of junction of the matrix with the walls.

The size of the selected blocks should be such that they will by their dimensions assist by the friction in holding their place. As the gold should be soft and yielding, there will be no impediment by the size unless this should be out of reasonable relation to the dimension of the space to be filled. When the first layer is completed others may be made seriatim until the upper third or half of the cavity is filled, when the major part of the balance should be completed with cohesive gold. For this part my reliance has been upon No. 20. The amount of force required to effect the consolidation is not great, and as the gold is confined by the limitation of the space it can easily be brought into adaptation. When the automatic plugger can be used, the force of the short blows of this is sufficient. The Bonwill mechanical mallet is also well adapted in its force to effect the consolidation, and is peculiarly well suited to mesial surfaces.

I have in some detail thus described a procedure which, in my own experience and that of others, has proved of great value, not

only as a means of effecting good results, but as a measure which facilitates the completion of the most difficult class of operations which we are called upon to perform.

DISCUSSION.

Dr. Meriam.—There are many of our younger members who ought to know that to Dr. Jack we owe the matrix. After Dr. Jack made it known, not much was heard of it till about five or eight years ago. It then gained prominence, perhaps on account of Dr. Herbst's methods, and our shops and our offices were flooded with many forms of this device. Dr. Jack presented the matrix to the profession without patenting it (it was the trading element that did that later), and it is to him we owe it as a professional instrument. You can see by the paper to-night that the fixation of the matrix requires care and precision. In the hands of Dr. Jack the matrix reduces the filling of teeth almost to an exact science, but the probability is that it saves little time except in the finishing.

Dr. Fillebrown.—I learned the art of filling teeth without the use of the matrix, and I have been inclined to operate without it ever since. I have, however, used the matrix enough to know that it is a very valuable help in many cavities. It needs to be used with a good deal of discretion and care. The matrix must be considered as an important wall of the cavity, and the filling must be as carefully adapted to it as to the other walls. Unless you do, the filling is soft at the cervix and imperfect at the margins. We have found it a difficult thing to get students to use the matrix with skill. While the matrix that was invented by Dr. Jack and presented here to-night in connection with this paper is a valuable device, there are various improved forms in use to-day, and among them might be mentioned the Ladmore-Brunton. This is a steel band which encircles the tooth. The steel is thin enough to go between teeth that are very close together. The band is tightened around the tooth by means of screws.

Dr. Taft.—I have found the matrix especially valuable in compound fillings. The one I use is made of silvered copper. It is secured in place by a ligature passed through two holes punched through either end.

President Brackett.—Dr. Jack is not confined to the use of a matrix in the filling of corono-approximal cavities. This is one of his resources.

Dr. Ainsworth.—I never think of filling an approximal cavity in a bicuspid or molar, where the coronal portion is involved, without

a matrix. After investigating all forms of matrices, I now use thin cold-rolled steel, which can be bent, and yet retain, to a certain degree, its elasticity. The Perry separator is an excellent device for holding a matrix is position. A piece of orange-wood can be adjusted at the cervical wall. To my mind, the matrix saves time not only in finishing, but all through the operation. It also enables one to build up a bicuspid badly gone on both mesial and distal sides, and for this purpose a band of German silver completely encircling the tooth is very convenient. It can be held in position by packing cement on both sides.

I have never taken up combination fillings of gold and amalgam, because with the matrix I can use soft foil quite as rapidly as amalgam, and with more satisfactory results. And it is very rare for fillings so made to give out.

Dr. Taft.—I cannot quite agree with Dr. Ainsworth that soft foil can be used as rapidly as amalgam in the cavities under consideration. As to matrices, silvered copper has a decided advantage for me, in that it lights up the cavity.

Dr. H. A. Baker.—I have probably used the matrix as much as any man in New England. I was the first one in New England to adopt it after Dr. Jack made it known, and I was also the first one to introduce the copper matrix, and then the silvered copper. I am using at present a thin steel matrix, and the Perry separator for fixing it.

Dr. Wilson.—I would like to ask Dr. Baker if he uses an absolutely soft gold with the matrix—a gold that cannot be made cohesive?

Dr. Baker.—I am now using an unannealed cohesive gold number three foil.

Dr. Meriam.—In England they usually speak of such gold as stale gold. It seemed a good word to adopt in distinguishing it from absolutely non-cohesive gold.

Dr. Adams.—There is one use of the matrix which has given me a great deal of satisfaction, and that is in very large buccal cavities in the lower molars which are to be filled with amalgam. Such cavities extending below the gum are very difficult to treat. I use a matrix of thin steel, concaving it with a round-faced hammer on a block of lead, then bending it around the tooth and tying with ligatures. This matrix is applied before the cavity is excavated, and after it is applied the rubber dam is adjusted. The matrix fits closely to the tooth and becomes a guide in excavating, and, if properly fitted, excludes all moisture.

Dr. H. A. Baker.—Have you filled such cavities where they extend beneath the gum?

Dr. Adams.—Yes. I do not use the matrix unless the cavity does go beneath the gum. I can carry the matrix down to the bifurcation of the roots, and it is a great assistance in excavating. With amalgam, of course, a very thin steel can be used, because there is not much pressure. The holes in the matrix are made quite low down, and the ligature is wound several times around the tooth.

Dr. Meriam.—The ring steel matrix can be used with great advantage in the case of badly-decayed molars requiring the restoration of more than one surface. The steel can be fitted as a ring, and soldered and left in the mouth until an amalgam filling has hardened. There is no more difficulty in soldering cold rolled steel than in soldering German silver.

Dr. Adams.—I wish to present a cast showing the cuspid situated between the two bicuspids.

Dr. Ainsworth.—I have been trying, to a limited extent, the method about which Dr. Clapp spoke at one of our meetings, of depending upon cement to retain gold in cavities where it is difficult to gain an undercut. I think highly of the method, and have been able to make several fillings which have seemed entirely satisfactory.

Dr. Robinson.—Just after Dr. Clapp mentioned the method alluded to I tried it in mesial cavities in bicuspids and molars, and also in frail centrals, and the results have been very satisfactory.

Dr. Williams.—Several years ago Dr. Buckland advocated a combination of cement and amalgam in cavities with frail walls. I used this principle, and from it the idea came to me of embedding crystal gold in cement while soft, and thus gaining a foundation for a gold filling.

Dr. Fillebrown.—More than twenty years ago cavities which were so large and with such small undercuts that it was useless to think of putting gold-foil in them I filled with oxychloride and allowed it to harden, and then cut grooves in it and filled over it with gold; such fillings did good service for many years.

Dr. Meriam.—It is about fifteen years since Dr. Kidder read a paper advocating the use of Canada balsam in connection with Watts's crystal gold for starting a filling.

President Brackett.—I had a case of a cavity in a lower incisor, involving the cutting-edge and distal surface. The extremely frail walls of the cavity rendered it impossible to make suitable retaining cuts, and I tried this method of putting Steurer's gold into soft cement and building on that as a foundation. The filling was com-

pleted, but inadvertently left prominent, so that for a week it was subjected to the extra strain of undue occlusion; yet it was not displaced. Since dressing it to proper contour several weeks have passed and it has remained absolutely undisturbed.

Dr. Eddy.—There is a preparation of gold made by the S. S. White Dental Manufacturing Company similar to Steurer's gold, but not as friable. It comes in small mats, and there is not so much waste as with Steurer's.

President Brackett.—If there is no objection, we come to Dr. Stoddard's presentation of a new dental lamp-fixture.

Dr. Stoddard.—I have been using this electric lamp for the past two or three months with considerable satisfaction. It is intended to be attached to an Allen table, and the wires can be easily connected with an ordinary electric-light socket. The fixture is pivoted to this brass plate, which is screwed on to the under part of the table. It can be moved forward or backward, and is easily adjusted. Vertical motion is supplied by the bracket. When it is not in use, it can be turned around out of the way. I use a sixteen candle-power Edison lamp, which is rather stronger than the S. S. White lamp, which, I believe, is but five candle-power. The lamp is cylindrical in form, and the shade is similar to the pulpit shade, and is perfectly adjustable. There is comparatively little heat from the light.

President Brackett.—I have seen this lamp in use, and it certainly seems a very efficient illuminant and free from the many objections to gas.

THE regular monthly meeting of the American Academy of Dental Science was held at the Boston Medical Library Association Rooms, on Wednesday, April 6, 1892, at 7.30 P.M., President Brackett in the chair.

Papers were read as follows: By W. Xavier Sudduth, M.D., D.D.S.; subject, "Dental Education."

By Charles H. Taft, D.M.D.; subject, "Silica: Its Curative Action in the Treatment of Alveolar Abscess."

DENTAL EDUCATION.

BY W. XAVIER SUDDUTH, A.M., M.D., D.D.S.

The question of the relation of dental colleges to the State laws governing the practice of dentistry in the United States has received considerable attention during the past year. It seems to me that nearly all who have taken part in the discussion have viewed the subject in the wrong light. Instead of its being the State laws *versus* the colleges, it is the colleges, or a part of them at least, *versus* the laws.

The impression has gotten abroad that all the colleges belonging to the National Association of Dental Faculties are united in the opposition now being hurled at the State boards of dental examiners. This certainly is not the case in Minnesota. The law has no warmer supporters in this State than the Faculty of the College of Dentistry of the University of Minnesota. How many other colleges in the country look upon the question in this light I am unable to say, but I think that when the attitude of the different schools is canvassed it will be found that not a few are in favor of wise legislation on the subject. I do not think that the members of the boards should be brought into the discussion at all, except where it can be shown that they are not doing their duty. They are simply officers of the law, and have no option but to enforce it to the best of their ability, and they should have the hearty support of the people who enacted the law. As a rule, they are conscientious, capable men, who perform a thankless task at a considerable sacrifice both of time and means. From personal knowledge I know that such is the case with the members of the board in Minnesota. Feeling the injustice of much of the criticism passed upon them,

we took occasion in our last announcement to state the position of our school in no uncertain language, as follows:

"The Faculty of this college recognizes the right of each State to control the practice of dentistry within its borders by regularly appointed boards of dental examiners."

There would be just as much injustice in abusing a policeman who should arrest you for breaking a well-known city ordinance, such as fast driving, for instance, as to blame the members of the boards for executing the law as they understand it. It is the law, then, that we have to deal with, and not the State boards.

What is the history of the enactment of the laws found on the statute-books of nearly all the States at the present time? It has been one of self-defence in nearly every case, for as time went by States without laws found themselves "becoming the dumping-ground for the charlatan and the ignoramus who had been driven out of other States." The enactment of laws governing the practice of dentistry in a few States forced all the rest to legislate against empiricism as a matter of self-defence.

As the standard of dental education has advanced, the laws enacted have, in most cases, become more rigid in their requirements, and many that passed laws early in the history of dental legislation are now finding them inoperative, to a greater or less degree, and are seeking to amend or entirely replace them. These laws are passed for the protection of the people, and not for the interest of dentists or dental colleges. A few of the States, recognizing the value of a college education, have thrown such restrictions around the privilege of examination as to debar all but college graduates from availing themselves of it; the medical law in Minnesota states explicitly that none but college graduates are admissible for examination, and prescribes the length of course which must have been pursued; while the dental law allows a little more leeway, yet it does virtually the same thing by making the time of credit for practice an increasing one from the date of the enactment of the law, which will in time debar all but college men from entering practice in the State.

New Jersey has also placed a premium upon a college education, and a large proportion of the States, in accepting college diplomas for registration without examination, have acknowledged the value of college instruction.

All these advances have been made by the several States voluntarily, under the impression that the colleges would appreciate them and fulfil the trust bestowed in them. The administration of the

law in States that require all candidates to pass an examination has shown that not all incompetents were non-graduates, fully as large a proportion coming from the so-called reputable colleges.

It was found that a very large proportion of men presenting with diplomas were not, in the judgment of the members of the boards, safe men to intrust with the care of the mouths of the citizens of their State. The result has been wide-spread distrust in the honesty of the intentions of some of the colleges, and a growing impression that the only safe way to guard against the admission of incompetents is to require all candidates to pass an examination before being granted a license to commence practice.

What has brought about this change in the attitude of the State laws towards the colleges? Nothing else than the flagrant abuse of the confidence which was at first shown in the colleges. They are now only reaping the reward of a betrayed confidence. The seed of distrust has, however, been sown, and will, under the same law of self-defence which caused the enactment of the laws in the first instance, require the amendment of existing laws until all the States will require all candidates to pass a test examination. Thus are the many made to bear the sins of the few.

Should such a condition come to pass, it would be nothing more, however, than is required of our sister professions; laws for the control of the practice of law even more rigid than have been established in any State for the practice of medicine or dentistry have long been on our statute-books. Graduates of all our law schools must, after graduating, pass an examination. They must, in addition to legal fitness, possess and maintain a good moral character, or they can be "disbarred" at any time. If they desire to remove, they must obtain a certificate from the court before which they were admitted to practice for registration in another State. If they desire to practise in the Supreme Court of the United States they must sustain a good reputation for a specified time, and then pass a second examination to show their fitness for the higher courts. We hear nothing from Columbia, Harvard, or the University of Pennsylvania about the non-recognition of their legal diploma, and why should such an outcry be made against those States that see fit to require college graduates to pass an examination before granting them licenses to practise dentistry?

If a graduate of the College of Literature and Arts of Princeton, Yale, or the University of Pennsylvania desires to teach a district school in the backwoods in Illinois, he is required to pass an examination as to his fitness to do so before the county superin-

tendent of schools, which must be repeated every two years. It is true that he may pass the State examination, which will give him immunity for five years, and still we hear nothing from their *alma mater* in behalf of these much-examined candidates who thus enter into competition for a share of the public funds. If, then, a legal or literary diploma does not carry any power to license the possessor to practise, teach, or preach, why should a dental diploma authorize its possessor to practise dentistry in any portion of the United States he may fancy, and become a perpetual license at that, as some would have it? What is there in dental education that makes a man non-amenable to the laws of the State in which he desires to practise? The situation is unique and plainly absurd on its face. There is no reason in asking that graduates in medicine or dentistry should be granted favors that are not accorded to law or literary graduates. Both the latter professions afford much greater opportunity for injury to the people than does the former.

If a man wants to employ a lawyer or a teacher, he can take his time to inquire into their qualifications, but if he gets sick or has a toothache, he has, many times, to employ the first one at hand and trust to luck for the results.

In that degree that a profession has to do with the public weal, so should the restrictions of law be thrown around its practice. A medical or dental diploma should represent the standard of education in the institution granting it, the same as a law or literary diploma, and no more. It should not carry with it the license to practise outside of the State in which the institution is located, and here in Minnesota we do not ask even that, but require graduates of the University to pass before the State Board just the same as other candidates, and, what is more, we find it beneficial in that it helps us to maintain a high standard in our own college.

To grant more than exemption from examination to its graduates in its own State would allow an institution to set the standard of education in other States, and would be in distinct violation of the right of each to control its own internal affairs. This privilege is one of the most cherished rights reserved to each State as it enters the Union. It has called forth more discussion than, perhaps, all the other clauses of the Constitution. More eloquence has been spent and more legal acumen brought to bear upon it than any question relating to State comity. There is no question that is guarded by the State more jealously than the right to regulate its own internal affairs, none that its citizens would sooner shed their blood for, except, perhaps, to defend the nation's interest. The close

scrutiny and the legal discussions that have been handed down in the past have so defined its powers and limitations that it hardly seems possible that a break could be made in the claims made by the several States in this direction.

A quite recent decision in the United States Supreme Court bearing directly upon the point in hand was handed down in the "Original Package" discussion. In this case certain parties doing business under charters granted by the State of Illinois tried, under the head of "Inter-State Commerce," to force the sale of high wines and whiskeys in the original packages on the market in the State of Iowa when the people of that State had said by legal enactment that they did not want them. This was the last stronghold of the opposition, and unlimited means were expended by these wealthy corporations to gain their point. The decision was, however, adverse to their interests, the Court holding that the State of Iowa had not only the right, but the power, to control the liquor traffic within its own jurisdiction. Various other attempts have been made within the past few years under the same head, but invariably with the same result. The motive in each instance has been a mercenary one. Strong corporations have been willing to override the will and the good of the people in order that they might make a few more miserable dollars.

Let us see if we can find a parallel in the case in hand. Certain colleges doing business under charters granted them in the States in which they are situated find that the people of other States, for their own protection, are enacting laws that interfere with their business of producing dentists, in that said laws place a restriction on the absolute free entrance of their graduates into said States for the practice of their chosen profession, and they therefore threaten to force these States to give up their inalienable right of attending to their own internal matters, because in so doing they have run counter to the interests of a few private business corporations.

In what way have the laws interfered with their business? They have only said that the quality of the product of dental colleges, like that of other institutions, say creameries, must reach a certain grade or else it cannot find place on their markets.

Do the laws anywhere prevent the entrance of thoroughly qualified dentists into practice? Not in a single instance; on the other hand, such are heartily welcomed. If such is the case, then the inevitable result of the operation of dental laws will be to send a student to those institutions that can assure him such preparation as shall fit him to pass the dental board of the State of his choice,

otherwise his diploma, obtained "at so much cost of time and labor," would be "worthless so far as permitting the holder thereof the right of practice." This would certainly be the case unless the individual could demonstrate that he was possessed of the qualifications which his diploma claims for him, and if he had them in his head and at his fingers' ends, it surely would be no great task for him to prove to any State board that he was really the individual named in the document. To do this would not require more than a few hours' time, and would surely be worth the effort just to get the signature of the secretary of the board, who is a legal representative of the law.

From some of the discussions on this question it would seem that there is doubt as to the "keeping qualities" of the product of some of our colleges. Granting that it is "A No. 1" when put out as shown by the document duly signed and sealed that is sent with each package, it might be well to establish a system of "rapid transit" from the "diploma mill" to the offices of the State boards in the several States; and as the product in some instances seems very likely to deteriorate in transit, as has been shown in the case of our own State examinations, where as high a proportion as five in nine failed to pass inspection, it does seem that it might be well to establish a system of "refrigerator cars," and for the moral influence it may have label each separate consignment "Original package."

But, jesting aside, the question as I look at it, when stripped of all prejudice, has a purely business aspect, to which let us turn our attention for a moment and see what light we can gain thereby. The strongest opposition to the enactment and enforcement of State laws governing the practice of dentistry is found in those schools that hold their charters as "private institutions," and who look upon their "plant" as a "vested right." They are in the business of turning out dentists, and they naturally desire to do so at the least expense possible, consequently are opposed on "business principles" to all State regulations that look towards the elevation of the standard. They went in with the rest for a three years' course because that played right into their pockets. Students must now remain one year longer in attendance, which means more time in the infirmary and an additional year's fees. But to raise the standard would require a selection of the material to be taught and better facilities for instruction, all of which would increase the expense and lessen the profit. The rejection of poor material by a higher entrance examination would lessen the number in attendance, and consequently cut down the *profits* of the infirmary. Then again,

improved facilities would incur considerable expense, which would have to come *directly out of the profits* of said infirmary.

The plain statement of the facts of a case are never agreeable to all concerned, but it does seem to me to be about time to draw a line between the really professional schools and the " dental infirmaries." Exposures are never pleasant tasks, but when it is currently reported that one institution cleared sixteen thousand dollars in its infirmary during the session of 1889–90, and twenty thousand dollars in 1890–91, and that another reached the fabulous sum of thirty-six thousand dollars for 1888–89, and with the same management and an increased attendance of students in 1390–91 there was, in all probability, a proportionate increase in infirmary receipts, it does seem time that some one should call attention to the subject. Many other instances of the abuse of the dental infirmary might be cited, but these well-authenticated cases will suffice for my purpose.

I do not think there is any risk in saying that the cause for most of the opposition to State dental laws at the present time lies in the pernicious influence of our dental infirmary system. A mercenary spirit has crept into our colleges through the "open door" of the infirmary, in many instances completely overshadowing the primary object for which they were established.

A close analysis of the opposition to State dental laws will show any fair-minded man that the strength of the opposition bears a very close relation to the size of the balance-sheet of the infirmary of the college. This is quite natural, as the larger the profits the more at stake, and also the greater amount of ready cash on hand with which to obstruct dental legislation. In some instances this has not been confined to the bounds of their own State, as some institutions have gone outside and used means to prevent the passage of laws which the people of a sister State had framed in its interest, because the enactment of such laws would, to a greater or less degree, be inimical to the interests of said colleges.

The remedy for the situation lies in supporting just laws in every State in the United States. It is not essential that these laws should be uniform. Uniformity means a compromise, a lowering of the standard, and would militate against progress. Let each college do its duty by its students and come tò the standard set by the most rigid law, and there will be no more need of complaint. It is impossible to harmonize the differences between the colleges and the State boards in any other way. The members of these boards have no option in the matter. It is their duty to execute the

law as they interpret it. It has been said that at the meeting at Saratoga last summer the National Association of Dental Examiners "refused absolutely to be a party to any compromise." What else could they have done? They did not make the laws. What would "perfect unison" in such a case mean other than that the officers of the law had conspired to defeat the wishes of the people as expressed in the law? It has also been said "that a truce has been arranged for the present;" said truce is, however, only a "recommendation," and not mandatory upon the boards of the several States. The Board of Dental Examiners of the State of Minnesota has been compelled to send its resignation to the National Association because it could not comply with that portion of the recommendation referring to a partial report of the work of the board, our law being explicit on this point and requiring a full, detailed report.

I cannot see wherein "the interests of all are jeopardized by the present antagonistic position," as is held by some. I am sure the State boards can stand the antagonism. They have nothing to fear. So long as they faithfully perform their duty the people will stand by them, and if much more opposition is made to the execution of the law so as to increase the labors of the boards, they will vote them an increase in salaries. Outside opposition is the strongest argument to the people of the necessity of dental legislation. On the other hand, only good to the dental profession can come from a free discussion. The attitude of the different colleges will be shown, which will, in the end, work to the elevation of the standard of dental education. Some very plain words will pass before the question is settled. It is needless to look for any compromise steps to be taken by the States in the matter. The colleges might just as well accept the situation at once and take such action as will put them in harmony with the law. The interests of the many cannot be sacrificed for those of the few. I consider that the future is bright for the scientific advancement of dental education in this country.

DISCUSSION.

President Brackett.—Gentlemen, this paper is before you for discussion. It is plainly the work of an earnest man, who has the courage of his convictions, and he presents strong arguments in support of his ideas. The matter of dental education has excited

much interest in this community, owing to what has been considered the somewhat peculiar position of other States.

Dr. Fillebrown.—My own position in this matter, and, I believe, also that of the Faculty and alumni of the Harvard Dental School, coincides with that of Dr. Sudduth. There is, therefore, no room for discussion. I heartily commend the paper, and wish that every State in the Union had a law like Massachusetts, requiring that every dentist who wishes to practise should pass an examination.

Dr. Andrews.—I agree with Professor Fillebrown, that the paper is so sensible in every way that there is very little to discuss. One thing I would like to say, and that is, I believe thoroughly in "every tub standing on its own bottom." We know that the graduates of certain colleges are allowed to practise abroad without examination, while the graduates of others are not. Let a system of universal examination be brought into use, and fairness and justice will be done to all. In some of the States dental colleges are owned by their professors, and are run for the profit they can get out of them. Much of the opposition to the ruling of State law and State examinations has come from colleges whose Faculties are deeply interested in the profits of the institution. I believe heartily in the sentiment of the essayist.

The board of State examiners should, however, have some respect for what the dental colleges have done. A case occurred in the Boston Dental College where a student was rejected by the Faculty, but passed by the State examining board.

Dr. Grant.—We as dentists ought to exert our influence to settle the proper relations which should exist between the dental colleges and the State examining boards. The dental colleges of a State should go before the Legislature and ask that they might appoint an examining board to determine the qualifications of candidates for graduation in the dental schools, with the power of granting licenses to such graduates and others who may be qualified to practise.

There are many instances where a feeling of general bitterness has been expressed towards a dental school by an unsuccessful candidate for graduation, because he thought his rejection was unjust, being influenced in a certain degree by personal feeling on the part of some member of the board of instruction in the school. If an independent board of examiners passed upon the qualifications of all candidates no such feeling could exist. Where the executive of a State is left to appoint an examining board simply from personal acquaintance or the recommendation of another man, it is no wonder that often the proper persons are not appointed.

Dr. Cooke.—Considering the history of our dental law, it is a wonder to me that we have one at all; it is extremely fortunate, in my opinion, that the whole matter of dental legislation was taken out of our dental societies and put where it is. If, instead of one operation, a candidate were required to do five or six before the State board, there would be a better opportunity to determine his ability.

Dr. Banfield.—It seems to me very inexpedient to examine and pass a man on one simple operation.

Dr. Andrews.—The State board should have the State society back of them for advice and reference. The Massachusetts Dental Society should attend to this.

Dr. Fillebrown.—I am in full sympathy with the board, and believe thoroughly in the institution. If I criticise their actions, it is done merely to urge to higher standards.

SILICA: ITS CURATIVE ACTION IN THE TREATMENT OF ALVEOLAR ABSCESS.

BY CHARLES H. TAFT, A.B., D.M.D.

The subject which I wish to present for your consideration is, in my opinion, an important one; not because I consider the remedy by any means a specific for the general treatment or cure of alveolar abscesses, but because I consider it to be a remedy which, when used with intelligence, will be found to be as useful in the hands of the dentist as it is in those of the physician.

There are probably few among us who do not frequently have cases in practice that seem to call for systemic rather than for surgical or mechanical treatment. When, for instance, pathological conditions are brought about by a disturbance of the vital force, resulting in an abnormal functional activity of an organ or tissue, and when we are called upon to prove to the patient that we have both the knowledge and ability to correct and to overcome such disturbances and thereby to disprove the all too prevalent idea in the public mind of to-day that dentistry is even yet but little better than a tooth-pulling, or even a tooth-saving, art.

Common among the every-day cases coming to us for treatment are alveolar abscesses, the etiology of which we are, of course, familiar with, and concerning which nothing need be said. They are commonly divided into two classes,—the acute and the chronic

forms; the former being such as easily yield to treatment, the latter being such as do not so readily yield. It is this latter class that I wish particularly to consider, and to show how far the suppurative process can be materially modified and controlled, if not, indeed, made to disappear entirely.

To illustrate, permit me to cite a case in practice which I can safely assert has been the most obstinate, with one exception, in yielding to treatment that I have ever had to deal with.

On February 23, 1891, Miss B. presented herself at my office complaining of severe pain in the right inferior second bicuspid, a large corono-mesial filling having been inserted a year previous by a dentist abroad. Upon examination the pulp of the tooth was found to be dead. It was then thoroughly removed and a dressing applied, the cavity being temporarily sealed with gutta-percha. She presented herself the following day with her face badly swollen, and the process of suppuration had advanced to the stage which made the lancing of the abscess a simple and easy matter. Both gutta-percha and cotton dressing were then removed and the cavity allowed to remain open for a few days until the swelling had entirely subsided and a fistulous opening had become established, which appeared, rather curiously, on the hard ridge of the alveolus directly behind the tooth (the sixth-year molar having been previously removed), rather than opposite the extremity of the root, where we should naturally expect to find it.

At the following sitting all traces of pulp-tissue and débris were removed from pulp-chamber and root-canal, and a cotton dressing dipped in creolin applied and temporarily sealed in place.

At the next sitting the dressing was found to be absolutely clean and sweet, and the fistulous opening, instead of healing up as was to be expected,—the exciting cause having been removed,—grew larger, the tissue directly around the opening assumed an angry bluish-red appearance, and the discharge of pus was sufficiently large to be at all times noticeable and very annoying to the patient. A large-sized probe could be easily carried along the fistulous tract to the apex of the root.

Renewed efforts were made to effect a disappearance of the abscess by treatment directly through the root-canal and the fistula itself.

Resort was had to a method which I have on previous occasions found very satisfactory in obstinate cases,—namely, that of passing a very sharp burr along the fistulous tract and cutting away the sac attachment so far as possible from the apex of the root, after-

wards syringing it out with a strong solution of peroxide of hydrogen, followed by a weak solution of carbolized water.

The patient presented herself frequently from February 23 to October 3. Upon each occasion the dressing previously applied was found to be without the slightest trace of odor other than its own, while the fistulous opening remained the same, with the same ugly, inflamed appearance and copious discharge of pus.

Both patient and operator were beginning to get somewhat tired of the slow process of healing, and at last I frankly confessed that I had exhausted all the known dental means and methods with which I was conversant for the treatment of alveolar abscess, and remarked that I thought it was now time to see what medicine would do in the case. The tooth had, in the mean time, become much discolored, but, aside from the annoying discharge of pus, was of no discomfort to the patient.

With a knowledge of the physiological and medicinal action of silica, and its remarkable control over the suppurative process, the patient was given six powders in the two-hundredth potency of the drug, with instructions to take one powder dry on the tongue every night before retiring, and at the end of a week to come in and report. At the expiration of a week she presented herself, and there was visible a very decided improvement in the appearance of both fistula and the parts around it, as well as a very marked decrease in the discharge of purulent matter.

The patient remarked that the improvement began to be immediately noticeable the day following the taking of the first powder. The same medicine was then repeated, with instructions to take as before, and at the end of a fortnight to come in again and report.

The next visit showed a continued improvement. The inflammation was slowly but steadily subsiding, likewise the flow of pus, and it required a much smaller-sized probe to be passed along the tract. No further medicine was given, but the patient was instructed to report at the end of another week.

The following visit showed still further improvement, and at first sight the fistula had apparently entirely healed, much to my intense gratification. It had by this time become so small that without knowing its exact location its existence, to a casual observer, would have been not easily discernible, but upon applying pressure upon the ridge a small discharge was seen to emanate from the opening, and a fine probe could still be passed along the entire tract to the apex of the root.

At this stage of treatment the silica was dropped for the time being and causticum given, and following that, a week later, fluoric acid; these also in the two-hundredth dynamization.

No perceptible change or further improvement was visible from the effect of either of these drugs, and the patient reported that the medicine had been without apparent effect, unless it was to continue the improvement which the first medicine had effected. She reported further that the discharge had been so slight as to be noticeable only upon pressure.

Feeling confident that the first selection of the medicine given had been the right one, there being an absolute lack of contingent symptoms to point to any other drug as being the similimum of their totality, and of which there is generally a greater or less number when the case is one that calls for systemic treatment; and knowing also that the curative power of a medicine when homœopathic to the case is greatly increased in proportion to the reduction of the dose to that degree of minuteness at which it will exert a *gentle* curative influence, I again went back to the silica, this time giving it in a much higher potency—the one-hundred-thousandth—and in the divided dose; that is to say, dissolved in water. The patient was instructed to report in a week, but three or four elapsed before she presented herself. The medicine having done its work so well, she had hardly thought it necessary.

This time, to my great satisfaction, as well as to the patient's, the discharge was found to have entirely ceased. The tissues had completely reassumed their normal color and appearance, but the tract still remained; so minute, however, that pressure failed to cause the appearance or further discharge of offensive matter. No further medicine was given and the patient was dismissed.

On March 8 the patient called to inquire if the tooth could not be permanently filled, not the slightest discharge having been noticed since her last visit, two months previous. The tract still remains, very minute as before, but no discharge can be made to come from it in any way, shape, or manner.

What, then, has been accomplished? In the first place, there was a localized disturbance or change in the vital force, brought about by a specific cause, resulting in a perverted nutrition and abnormal functional activity of both the organ itself and the tissues in relation thereto.

Secondly, all surgical efforts having failed to bring about a restoration to health of the parts concerned, and the case then seeming to be one pre-eminently calling for systemic treatment, a remedy

was selected whose value and power in controlling the suppurative process is well known to those who practise medicine in accordance with the teachings of Hahnemann, and which, in cases of simple abscess, has a brilliant clinical record.

Thirdly, in this, as in the process of any homœopathic cure, to quote the words of Hahnemann, "by administering a medicinal potency chosen exactly in accordance with the similitude of symptoms, a somewhat stronger similar artificial morbid affection is implanted upon the vital power deranged by a natural disease. This artificial affection is substituted, as it were, for the weaker similar natural disease (morbid excitation), against which the instinctive vital force, now only excited to stronger effort by the drug affection, needs only to direct its increased energy; but, owing to its brief duration, it will soon be overcome by the vital force, which, liberated first from the natural disease, and finally from the substituted artificial (drug) affection, now again finds itself enabled to continue the life of the organism in health."

From what I have stated the impression may go forth that equal success in the treatment of alveolar abscesses might ensue from the indiscriminate employment of this drug as a sort of specific in all forms of this pathological condition, but this is by no means the case.

It would be both interesting and profitable, were it within the limits of the paper, to consider the action of other medicines equally valuable in the treatment of abscesses, and to show why a remedy would prove effectual in one case and totally ineffectual in another; but for the proper selection of any remedy in a given case the fact should not be lost sight of that a knowledge of the physiological or toxical action of a drug is, in the first place, most essential. By this I mean we must know what pathological conditions are brought about when a proving of the drug is made upon the healthy human organism: what tissues are affected, and in what way they are affected; for it is only by comparing the symptoms of your patient with those which different drugs produce upon the healthy body that a correct or scientific knowledge of their curative action can be obtained. Without this knowledge one would wander blindly in making his selection of a remedy.

To some of those who may be unfamiliar with the great number and variety of medicines to be found in the homœopathic materia medica, it may appear incredible or absurd that a substance which in its native form is simply the pure silica of quartz-crystal, and which in its crude state is but an inert mineral substance, can

have any medicinal action; and not less incredible and absurd when administered in the potencies I have described. But it is only after such a substance has been triturated with a non-medicinal substance, a process whereby its molecules become comminuted or broken up, that its medicinal properties are evolved. The different potencies of the drug being then carried up by the fluid process or succession, the higher the potency the more powerful its action, and the greater care and discretion in consequence to be exercised in their use.

The action of the drug we are considering is a slow and deep one,—the nutrition of the tissues which come within its sphere of action rather than their functional activity being especially influenced by it, and by reason of its slow action is suited to chronic rather than acute affections. But it is in cases involving profuse suppuration that its value as a therapeutic agent is especially appreciated, where abscesses can be made quickly to come to maturity and the secretion of pus either modified or brought entirely under control.

I have heard it stated by men prominent in our profession that medicine is not and never can be an *exact* science. To this broad statement I feel compelled, through convictions established within me based upon evidence and experience, to take exceptions.

It is not my purpose, however, to encourage discussions of a general character at this time upon what properly belongs to another subject, and upon which much has heretofore been written and said; but speaking for myself alone, and as a dentist who believes most assuredly that medicine (or if I may be allowed to qualify the word by substituting homœopathy) *is* an *exact* science, not a speculative theory; a principle, a law of nature as universal in its application as any of the natural laws which govern the universe; and that dentistry is, or, at least, should be, in a broad sense, a specialty *of* medicine. I cannot conclude my remarks upon the subject before us better than to express the satisfaction I daily find in applying a rational and intelligent knowledge of the materia medica, so far as I understand it, in the treatment of such organic or functional disturbances as properly come within our province as dentists; and where the use of the ordinary and rather limited number of dental therapeutic agents at our command prove either only temporarily useful and satisfactory, or, what is often found in the long run to be the case, wholly unsatisfactory and therefore largely useless.

DISCUSSION.

Dr. Hitchcock.—If I understood the essayist correctly, he began treatment in February, 1891, and ended in March, 1892. It seems to me that if the abscess was not cured in less time than that, silica had little to do with it. I would like to ask Dr. Taft whether he purchased his peroxide of hydrogen or prepared it himself.

Dr. Taft.—I purchased it.

Dr. Hitchcock.—If I remember correctly, peroxide of hydrogen is dormant at a temperature below 40° F., and at a temperature of over 70° it loses its oxygen. The solution should be made by a competent chemist, and kept in a cool place.

Dr. Williams.—Dr. Taft's mention of the use of silica reminds me of a case I had fifteen or twenty years ago. It was a very obstinate ulceration, occurring after the extraction of a tooth. The patient was not in very good health, and suppuration continued for some time. I tried various remedies without effect. Dr. Cabot, who was an excellent surgeon, gave me a hint. It was to apply silicate of soda, a little diluted, perhaps half or two-thirds strength, on a bit of cotton. That seemed to have a very good result, and I applied it once a day for several days, and I think in the course of ten days the case was healed. I have found it very useful in several cases since.

Dr. Cooke.—I would like to ask Dr. Taft what was the strength of the dose he used in the last case.

Dr. Taft.—The medicine I last gave was in the one-hundred-thousandth potency.

Dr. Cooke.—I do not understand what virtue there can be in a solution made from the hundred-thousandth potency.

Dr. Taft.—I hope the gentleman does not confound a simple dilution with a potency. If you put a couple of drops of a drug in a bucket of water you get a solution with no value as a medicine; but if you take two drops of that drug and add ninety-eight drops of alcohol, and shake it, then you get a potency; then take two drops of that and add to it ninety-eight more of alcohol, and shake again, and so on,—in that way you evolve the medicinal properties of a drug.

Dr. Williams.—This shaking must be done by hand, as I understand it. Wouldn't it have the same effect if the solution were put in a machine and shaken up?

Dr. Taft.—I should think the effect would be the same. I don't know about that.

Dr. Allen.—I have no experience in administering homœopathic remedies in dentistry; but, if you wlll allow me, I would like to speak of two cases of their use which interested me a great deal. Each case happened to be in the family of a homœopathic physician, both physicians being eminent in their profession. One case was a chronic alveolar abscess, which originated in a central incisor that had a Richmond crown on it. The crown had been placed there by a dentist who is well known to most of us, and there is reason to believe that he had thoroughly prepared the root, and had filled it properly. Notwithstanding that, an abscess formed; followed by a fistula and a copious discharge of pus, which condition seemed to indicate the removal of the crown and further treatment of the root. I suggested to the doctor that he try his homœopathic remedies on it,—certainly a safe thing to do, you would say,—and that the dentist should not interfere until it became imperative that he should do so. My suggestion was followed, and the result was eminently satisfactory. I had occasion to examine the lady's mouth afterwards, and the apparent healthy condition of the root fully warranted the course that had been pursued.

The other case was an acute alveolar abscess in the left superior second bicuspid, which also had a crown upon it. The lady's husband was a physician, and an enthusiast in homœopathy. He refused to have the dentist treat the case, saying that he would take care of it himself. As there was very great swelling and much fever present, I did not believe that speedy relief could be obtained without lancing the abscess, nor a cure effected without opening the root. The abscess, however, was not lanced, but homœopathic remedies were administered internally, and relief followed within a very few hours, together with a rapid subsidence of the swelling.

If it is not irrelevant to the subject, I would like to give a personal experience in regard to homœopathic medicines. It was my ill fortune several years ago to injure the instep of my right foot. I was in a lecture-room, and a number of students were seated on a settee directly in front of me. They were leaning back, and finally tipped over, and I received the weight of that row of students on my instep. The injury seemed trifling at the time, but next morning my foot was very lame, and for several days continued to be so, when, happening to mention my accident to a friend who was a homœopathic physician, he said, "Let me prescribe for it,—I will

give you some arnica." Said I, "Yes, I think arnica would be very good to rub my foot with." He replied, "You must take it internally." I laughed, and had no faith whatever in it, but took his dose, and next morning my foot was very comfortable, and continued so for several days, when the trouble again appeared. To make a long story short, the trouble would subside, and then reappear at intervals of a few days, the relief always being coincident with a dose of medicine administered internally. After the absence of six months, during which time the trouble again appeared, I went to him for an examination. He said the periosteum had been bruised, and that a bone abscess was threatening. At my request he prescribed for me, and told me that later on I would know what the remedy was. Relief followed immediately, and has been permanent. In reply to my question afterwards as to what the medicine was, he said it was the one-hundred-thousandth potency of arnica.

Dr. Williams.—I would like to ask the gentleman if in any of these cases silica was used.

Dr. Allen.—I do not know. It would be very easy to find out. I know that silica is used by homœopathic physicians in cases of suppuration.

Dr. Andrews.—I want to say a word in appreciation of this paper. I don't think we have had a better-written one in this association for a great while, and although I am not able to discuss it, I am glad that I have heard it. The action of homœopathic remedies does not seem at all improbable to those who have prepared microscopical tissues, and have noted the effect that minute percentages of reagents have on them.

Dr. Hitchcock.—I do not want to be understood, Mr. President, as criticising the practice of homœopathy, as I have some faith in it. But I was surprised at the length of time required for treatment in the case described by Dr. Taft.

Dr. Taft.—The case was undergoing treatment during that period mentioned, but I was not using silica all that time. I would say that the effect of one dose of silica will go on in the system for as long as eight weeks. I think my mistake in the treatment of the fistula was that I produced what is called an aggravation by repeating the medicine a second time too soon. I felt sure, after I had given the other two remedies without any result, that if the silica were given in a very high power it ought to cause the flow of pus to cease entirely, and the result bore out my conclusions. It shows how beautifully the higher potencies work, and shows, too, that the

very word "potency" means power, and the higher the potency is carried the greater the discretion to be exercised in the use of the drug.

Dr. Eames.—I have always understood that mischief would not be incurred if the remedy was not applicable, or, as is popularly said, "Homœopathic medicines do no harm, even if they do no good."

Dr. Taft.—Well, if the selected medicine is not the *similium*, and does not reach the totality of all the symptoms, it has no effect. For instance, let a person when well take a few drops of the tincture of gelseminum. If he is at all sensitive he will notice in a few minutes that his pulse has from ten to fifteen beats fewer in the minute than it had before, with a feeling of chilliness accompanying it. This will soon be followed by heat, a quickened pulse, with pains in the head, and perhaps in the back and limbs. In short, he will find that he has a fever. Soon a prickling sensation is felt, perspiration breaks out, and in a little while he is well again. Now, it is just because gelseminum produces fever symptoms when given in large doses that it cures the same symptoms when administered in small doses.

Dr. Eames.—Then, if one had no disease at all, it will cause these symptoms in a healthy person? If a child gets hold of a vial-full of a certain drug and takes a quantity of it, it has the effect of producing the disease in the child for which the drug is used?

Dr Taft.—Certainly.

Dr. Eames.—I can hardly see how the shaking of the drug, as given by Dr. Taft, is different from the dilution.

Dr. Taft.—There are a good many things that cannot be explained,—we have got to accept them as facts. We might say, for instance, that because we cannot understand how waves of a certain kind can be sent over an electric wire so that six messages can be sent from either end at the same time, that it cannot be done. We cannot understand how hydrogen and oxygen unite in certain definite, fixed proportions to form a drop of water, but we know that they do. Just how this action is obtained with drugs nobody knows, but it is a law, and a fixed law, as those who have tested it well know.

Dr. Meriam.—Do we understand, then, if we get a remedy that meets all the symptoms, there is no death?

Dr. Taft.—I do not go so far as that,—we are talking of curable cases.

Dr. Briggs.—I would like to ask Dr. Taft if he uses silica in all cases of alveolar abscess, as in the one case that he has cited.

Dr. Taft.—No, sir; by no means. I would not be understood as saying that I use silica in every form of abscess. I very often use mercuries or hepar sulphur, the administration of either one depending entirely upon the condition of the other symptoms. They are equally valuable with silica, providing certain symptoms are present. Silica is a very slow, deep-acting drug, and, as I have said, is suited rather to chronic than to acute cases.

Dr. Briggs.—It is inert, is it not, on healthy human organism?

Dr. Taft.—Not in its medicinal form. In its crude form it is practically inert.

Dr. Briggs.—What are the symptoms that occur in the healthy individual in its medicinal form?

Dr. Taft.—It affects the whole system, from the top of the head to the tip of the toe.

Dr. Briggs.—Does it produce suppuration?

Dr. Taft.—Yes, in its physiological action.

Dr. Briggs.—Does Dr. Taft know how many times that has been proven?

Dr. Taft.—I do not; but all of the symptoms that are ascribed to it are not the provings that have been obtained by its administration to any one individual, but those that have been gathered from a number of individuals.

Dr. Williams.—I would like to ask if it is known who is the discoverer of this remarkable effect obtained by shaking by hand.

Dr. Smith.—I would like to ask Dr. Taft, if he gives this silica for chronic abscesses, as he cites in his paper, why it would not be equally serviceable for an acute form of abscess to allay the inflammation before suppuration takes place?

Dr. Taft.—Mercuries or hepar sulphur have the power to hasten suppuration or prevent it entirely; that is to say, if the proces- of suppuration has begun and cannot be averted, it will be materially hastened by the administration of either.

The case in question, Mr. President, was entirely without other symptoms. The lady was one of the healthiest individuals that I have ever seen. There was not a single symptom to aid in the selection of the remedy other than what was presented in the fistula itself. The fact that I had no success in treating it by dental agents or methods, and the fact that the discharge was so profuse all the time as to be exceedingly annoying, made it very pleasant for me to have her say of her own accord that she noticed an improvement the very next day after the administration of the medicine. It shows how nicely the medicine worked. We cannot explain how

it worked, but if the lady were here she would tell you there was no question but that it did.

Dr. Meriam.—There is one thing to be considered in connection with this case. From Dr. Taft's description I should judge that the fistula was entirely sheltered from pressure, and such are extremely difficult to heal.

Dr. Smith.—Dr. Taft has said that were his patient here she would tell us that he had not overstated the case. Any one who is acquainted with Dr. Taft asks no further evidence for the truth of his assertion than his plain, unsupported statement.

The paper, I think, has been an exceedingly interesting one. He has seen fit to venture into new fields and try these drugs, and he has made, under the circumstances, a creditable success of it; and, what is more, he has the courage of his convictions, and the heroism to come here and present them.

In my dental-student days we never were taught to use remedies to abort abscesses, and I doubt very much to-day if a majority of our practitioners in dentistry are in the habit of resorting to drugs of any kind to assist in treatment. I have had under my dental care some eminent physicians and surgeons, and have purposely asked them what drug they would recommend for use in the treatment of abscessed teeth, and those eminent men say, "None." The homœopathists claim that drugs have their proper effect and will cure, and I have had cases of this kind where the patients were homœopathic physicians, and while I performed the surgical part of it, they took what they considered the proper drug, and I have always got along with these in a thoroughly satisfactory manner.

We have had cases where it is claimed that Christian science cures. I have two patients who were under treatment with the best allopathic physicians for years, men who were eminent in their profession here in Boston, and after trying everything in their science, they gave them up as incurable. Those patients went to Christian science, and in two or three months' time they were well people. Naturally, these are firm believers in the Christian-science cure, and one of them who was particularly nervous is now a much better patient; in fact, she is an excellent patient. She states that she succeeds when in the chair in absenting herself from her body. And so, gentlemen, I pay my tribute of respect to the essayist, and I am inclined to try the treatment which he has outlined.

Mr. Houghton.—I have been under the care of homœopathic

physicians for the last two years. Before that time my health had been very poor, and I was under allopathic treatment for a number of years. I first came under the doctor's care when I was about twelve years old, and it was about that time that I began to have my teeth filled with amalgam and gold fillings. I kept growing worse until about three years ago, when I first came under the treatment of a homœopathic physician. At that time I think I was taking about a dozen different kinds of drugs, but soon began to improve under homœopathic medicines. My physician felt that I was not improving as fast as I ought, and ordered my amalgam all removed, and since then there has been a rapid change for the better.

Dr. Williams.—The gentleman, in relating his own experience, spoke of having two kinds of fillings in his mouth,—amalgam and gold. His physician recommended the amalgam fillings to be removed, after which he noticed a marked improvement. I want to ask if any effect was attributed to the remaining gold fillings by the physician?

Mr. Houghton.—Not that I know of.

Dr. Taft.—In closing I would say, Mr. President, that I had no intention, in presenting my paper to-night, to antagonize in any way the two great schools of medicine. It was simply to give you the benefit of the experience that I have had in administering an important and valuable drug, and incidentally I have spoken of other homœopathic remedies.

I brought with me to-night a small volume on homœopathy called "Hering's Domestic Physician," which has one or two chapters devoted entirely to the affections of the teeth. Usually there is no question about the symptoms of any case, because the patient can express those symptoms quite clearly. When a case presents itself I recognize at once certain "key-note" symptoms, which suggest a given drug. I then turn at once to the chapter alluded to, and look up the symptoms coming under it. If a large number of those symptoms do not come under that drug, I look up another, and go through as quickly as I can the different drugs to see which one has the largest number of symptoms corresponding to those of the patient, and when I find what I think is the right one, I take the large *materia medica* and confirm my opinions; then, with considerable confidence, give the medicine in the very high power I have spoken of.

I have also brought with me this medicine-case. It holds enough of the more important remedies which the dentist would need for

affections of the mouth and kindred troubles. It contains only a small proportion to the number of remedies that are used in the science of homœopathy.

I have just started to make a record of every case in which systemic treatment is adopted. In this record I put down the name of the patient, all of the symptoms present, the aggravation and ameliorations, and the medicine that I give, taking pains to find out from the patient afterwards what the action of the medicine has been. In a large proportion of cases relief is given at once, and in almost all within a day or two. In some I do not select the right remedy, and consequently have to give the case further study. In this way I hope in time to get a homœopathic dental *materia medica* that will be as accurate as my own practical experience can make it. I find systemic treatment just as useful in the management of an exposed pulp, which begins immediately to ache after a careful capping, as in cases where there has been continuous pain. I had such a one come to me about a month ago. A young lady suffered a great deal after a capping that I made in an inferior bicuspid. Notwithstanding the fact that I capped it very carefully, the tooth gave her considerable trouble, and for two weeks I tried capsicum plasters and all the local obtunders of pain with which we are familiar. At first they had good effect, but the pain would soon recur. I did not want to destroy the pulp of the tooth, so I took very carefully all the symptoms, and from what I could gather thought that belladonna was the indicated remedy. I gave her the medicine, but it had no effect whatever. I told her that before destroying the pulp I would like to have one more trial, and after making a further careful study of the case, prescribed mercurius, when the pain ceased almost immediately, and she has had no serious trouble with it since.

Dr. Briggs.—The key-note of the use of the drug is its high potency?

Dr. Taft.—Yes.

Dr. Briggs.—And don't prominent homœopaths practise only in the lower potencies?

Dr. Taft.—Yes, there are a great many of those. Their number is much greater than that of those who use the high potencies.

The regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms on May 4, 1892, President Brackett in the chair.

The paper of the evening was read by Charles E. Francis, D.D.S., M.D.S., of New York; subject, "The Hygiene of the Mouth."

THE HYGIENE OF THE MOUTH.

BY DR. CHARLES E. FRANCIS, NEW YORK.

It is a fact, apparent to every dentist of much experience, that comparatively few individuals in this country pass the first quarter-century of their existence and possess an unbroken and perfectly healthy denture. Even before their second decade of years has been reached, many individuals have suffered the agonies of odontalgia and lost forever a number of their priceless organs of mastication.

The value of sound teeth to members of the human family can hardly be estimated in way of comparison. Health, comfort, personal appearance, and length of life depend much upon their condition or their integrity. To care for them and to rescue them from the ravages of destructive agents is the mission of our specialty, and to achieve such results we bend our energies and direct our best efforts. It is for this purpose that we come together on occasions like the present. Well-organized societies also exist in every part of the land, where all matters pertaining to our practice can be presented and freely discussed. We listen to carefully-prepared essays on all subjects of interest to our fraternity; we have colleges established in various sections of the country for imparting dental instruction, and text-books teaching principles and methods of practice. We have also numerous literary periodicals teeming with rich thoughts and practical suggestions. We furnish our operating-rooms with the most approved appliances and stock our cabinets with the best instruments and choicest materials that have been devised or can be procured, and, indeed, equip ourselves with everything of value that will aid us in our operations and enable us to make such operations successful and satisfactory. It is, in reality, the one great object of our lives to perfect ourselves in the practice of our specialty; yet, with all our prearranged care and painstaking efforts, we find much that is unpleasant to contend against, much to disappoint our hopes and desires, much to under-

mine and destroy the results of our care and labor,—and it is on this point that I would direct your thoughts on the present occasion.

Patients come to us for attention presenting cases within the oral cavity of every conceivable condition and desire us to restore or repair all defects or deformities that exist therein. Children are brought to us with teeth crowded, irregular, and oftentimes discolored and decayed. We must gain their confidence, relieve them from pain, repair such teeth as are attacked by caries, remove fragments that are a source of irritation, and put their mouths in a condition of cleanliness. We are called upon to expand dwarfed or contracted dental arches, and bring teeth distorted and out of line into a condition of regularity: and all this to insure their preservation and beauty for many years of life in anticipation. And as those of maturer years come to us, other duties are required that likewise tax our time, skill, patience, and energy,—teeth decalcified and broken; crownless roots and jaws almost or quite edentulous; pulps of recent exposure and sickly pulps or pulpless roots. We are confronted with cases of pericementitis and the various stages of alveolar abscess, necrosis of alveolar borders, and sometimes fistulous openings perforating the antrum, recession of gums, absorption of alveolar process, and teeth loosely rocking in diseased sockets. All these and other disordered conditions are presented to the dentist, who is expected to treat them and care for them in an intelligent way and in the best possible manner. Indeed, he is often considered responsible for the preservation and well-being of the teeth of his patients for all future time.

Now, the ideal dentist may have been well trained in the several departments of his calling and proved himself competent to perform each and every operation given to his charge. He may be skilful and painstaking; conscientious in his endeavors to do the best possible thing for his patients, sparing no effort to perfect his operations and to make them a permanent benefit; but can he feel sure that after-results will not disappoint his hopes and that a lapse of time will not exhibit a sad reverse of reasonable expectations? Does the dentist, in reality, do all that is possible to prevent such unfortunate conditions?

Let us suppose that a patient has submitted to the ordeal of having his or her teeth put in what is usually termed "good order." All diseased roots of broken-down teeth have been extracted, every cavity carefully treated and filled, the teeth all around have been well cleansed, and everything so far satisfactory to both dentist and

patient. Does this complete the duty of the dentist towards his patient, and is the latter to be dismissed with no word of admonition,—no advice regarding the future care of the teeth, and no instructions for keeping them in a healthy condition and preventing a recurrence of such troubles as have just been corrected? Perhaps many of the gentlemen before me are in the habit of imparting the needed advice to those for whom they operate, but, if statements of the latter can be credited, many dentists are remiss in this duty, and give no word of heed or warning, nor do they picture the serious danger that such neglect incurs.

I believe that hygenic instructions well emphasized, and admonitions equally emphatic, are essentially important not only for the benefit of the patient, but for the good name and professional standing of the dentist as well. And in caring for the teeth, is not the ounce of prevention worth the sixteen of cure?

Every additional year of individual experience and observation impresses me more deeply with the importance of teaching to our clientele lessons of care and cleanliness to their useful organs of mastication. A famous medical writer and lecturer of your city, in one of his lectures on general hygiene, remarked that "if teeth could be kept entirely clean they would never decay." There is certainly a great degree of truth in this statement. We all admit that decalcification of the enamel-structure and destruction of the lime salts of the dentine are due to or hastened by vitiated accumulations lodged about the teeth. But *perfect* cleanliness of the dental organs is a condition which we hardly expect to find in the mouths of our patients; indeed, as a rule, they are very far from showing this pleasing appearance. It is *not* the simple and easy task that many persons suppose to give their teeth the cleansing they need. There are points here and there which escape the searchings of the tooth-brush, and too frequently they look as if a tooth-brush had never come in contact with their surfaces. People generally admire fine-looking and cleanly teeth as they behold them in the mouths of those with whom they meet and converse, and all admit that they add greatly to personal charms, yet few individuals give half the length of time and amount of care actually needed to keep their own teeth in a healthy condition. It is doubtful if, as a rule, when making their own toilet before a mirror, they think of scrutinizing or even looking at their teeth; indeed, it is more than likely that at such times they keep their lips rigidly compressed and have but a faint conception of the condition of the organs hidden beneath. If they give them any thought at all, they con-

tent themselves with the belief that they have performed the somewhat irksome duty of brushing them; which duty, however, has been done in so hurried a manner as to have but little beneficial effect.

How painfully discouraging to the dentist, who has taken the utmost pains to nicely prepare cavities and make his fillings compact and durable, to find at a subsequent period his work subjected to the damaging influence of vitiated oral secretions! On the principle that like causes may produce like results, teeth having once been attacked by caries are quite likely to again succumb to the elements of decay where conditions remain unchanged. And where fillings give out or prove failures the dentist is supposed to have done imperfect work, so his reputation suffers to a greater or less extent.

It seems to be one of the most prominent failings of human mortals to saddle the responsibilities of their own sins of omission or carelessness upon the shoulders of others, hence members of our calling get more than their share of blame for the ill results of these neglected duties. We therefore owe it as a duty to ourselves, as well as to our clientele, to urge the latter to take especial pains to keep their teeth in a condition of cleanliness, and instruct them also how they can best accomplish this end.

I am aware of the fact that it is not a particularly pleasant duty to charge our patients with a lack of tidiness, and our criticisms may in some instances be viewed as an ungracious rebuke; nevertheless, as we have chosen the profession that calls upon us to preserve human dentures, why should we not make all reasonable efforts to save them from destruction?

Many individuals with very untidy-looking teeth will assert that they use their tooth-brush two or three times a day. Undoubtedly they *imagine* themselves doing all that is necessary, yet appearances indicate that their efforts are of little account. Some will excuse neglected duties on the plea of sickness and inability to do themselves justice, but many are proverbially careless or inexcusably negligent, and suffer their teeth to become thickly coated with limy incrustations. As a matter of course, such accumulations are a source of constant irritation to the gums. Wherever they encroach upon the gingival margins congestion follows, and the dental ligament is severed. As recession thus provoked continues, the mischievous deposits increase in quantity and become incrusted beneath the disturbed margins until the alveolar territory is invaded. This induces absorption of the

process, the deposits follow, and thus the work of destruction progresses. Any idiopathic tendency to pyorrhetic socket-disease is sure to develop where such conditions are permitted to continue.

When examining the mouths of my patients, I find few, if any, among them with teeth that cannot be improved if cleansed by the dentist. Even though they may appear white and cleanly to the casual beholder, and fairly well at first glance to the dentist, they can be made to look better and feel better after being nicely cleansed. This operation, however, if faithfully done, is much more of an undertaking than is sometimes imagined, requiring greater length of time and far more care than is usually given; and I feel that we can hardly be too particular in our endeavors to do this work effectually. I have observed that patients appreciate labor thus bestowed upon their teeth more than anything else we can do for them, and are sometimes profuse in expressions of satisfaction with the improved condition of their mouths.

Perhaps my method of cleansing is much the same as adopted by many of the gentlemen before me, yet it may not be out of order to briefly state it. Provided with sickles and scalers of various shapes and sizes, I usually commence by removing the most prominent scales of what is usually denominated, or *misnamed*, "tartar." The patient is supplied with plenty of tepid water for rinsing the mouth at frequent intervals. On the bracket table before me is a glass slab, on one end of which is a small quantity of powdered pumice-stone and borax, of equal parts, mixed. On the other end of the slab are several pellets of cotton about the size of a pea, and compactly rolled. A towel is pinned about the patient's neck to prevent the clothing from getting soiled when rinsing the mouth, or from the powder, should any fall from the brush. With an ordinary pair of tweezers, or gold-carriers, I pick up a pellet of cotton and saturate it with compound tincture of iodine. With this I paint the surfaces of the teeth, three or four at a time, commencing with the incisors, and at the same time, with the fingers of my left hand, keep the lips from coming in direct contact with this application. Then with a small brush fixed in the engine and loaded with the powder, I briskly brush away the stains. Sometimes the engine brushes are rather stiff at first to work well on the broad surfaces of the superior incisors, but they lose much of their rigidity if pressed a few times against the narrower surfaces of the lower incisors. The brush is passed along from tooth to tooth, but frequently removed that the mouth may be rinsed. This process is continued until the stains entirely disappear.

After finishing with the brushes, a moose-head buff is fixed in the engine, with which I go over the teeth to give an extra polish to all surfaces it can be made to reach, and call into service, also, wedge-shaped bits of wood, floss-silk, or wood-fibre, to work between them. Then, with a mouth-syringe, I force tepid water through the dental interstices to clear away the débris. After this washing a careful search is made for such stray atoms of calculus as may hitherto have escaped observation, and when no more can be found, I take a finely-pointed syringe filled with listerine and inject a small quantity between the teeth all around. Where the gums are congested, iodide of zinc may afterwards be applied. It is sometimes advisable for the patient to undergo a second operation; and where socket-disease exists, additional and frequent after-treatment is requisite.

The employment of tincture of iodine greatly facilitates the operation of cleansing, and especially is this the case with children's teeth. It has a wonderful and almost instantaneous effect on the dark stains, combining with the latter, which are rendered so soft as to become easily removed. It also clearly defines the lines of concreted mucus, and enables the operator to readily ascertain if any traces remain undisturbed. It should be applied a number of times during the operation, or until the teeth appear quite cleanly.

Now comes the important question, "How can teeth which we have so carefully treated be kept in the condition we left them?" or, "How can habits of thorough, systematic cleansing be imparted and so impressively taught that instructions may be faithfully carried out or practically demonstrated?" This is a matter that has given me much trouble and anxiety.

I have observed that patients are apt to become interested when we take the trouble to explain to them causes and effects: so during my operations, at convenient intervals, I sometimes give them a brief lecture on dental hygiene. In as concise a manner as possible I explain the causes of decalcification and of socket-disease, and picture the dire consequences of carelessness and neglect; also tell them how they may lessen the chances of such troubles, and secure to themselves sound teeth and healthy gums. Patients need be taught how to manipulate the tooth-brush, and at what times they can use it to best advantage. I advise them to brush their teeth both at night and in the morning, but to be particularly thorough in doing this just before retiring at night. I remind them of the fact that between the last, or evening meal and the morning repast there intervenes a lapse of about twelve hours, and during most of this

time the mouth is comparatively at rest. In the mean time, all particles of food collected about the teeth or filling their interstices are undergoing a process of fermentation.

During sleep the salivary glands are inactive, so no fresh saliva is secreted to dilute the acid formations; hence the acidulated agents work in their slow but sure way night after night for weeks and months, until damaging impressions are made on the tooth-structure. An impression once made is sure to be followed by further invasion, until quite a breach is effected on the calcific territory. We have been told that it is during the hours of sleep that the evil one sows tares, and during the hours of sleep the agents of decalcification do their most effective work. If the teeth are well cleansed at night they require but little brushing next morning. During hours of activity they derive benefit from the friction produced by the mastication of food, while fluids taken into the mouth at various times, and saliva freshly secreted, tend to dilute and check acid fermentation. Whenever I find naturally strong teeth with cavities all along their approximal, buccal, or labial surfaces, I am not surprised when inquiry discloses the fact that remnants of food taken during the day are permitted to remain about them through the night. To be sure, there are individuals with such defective teeth who pretend to use the brush at night, but its use is much like a dash and a promise.

I advise my patients to select brushes small enough to go well into the mouth and reach every possible part of every tooth. Brushes with serrated surfaces will better force the food from between the teeth than will flat-faced ones. The bristles should be stiff enough to be elastic, but not too rigid nor too compactly crowded together, otherwise they will simply glide over the surfaces without entering the interstices. On the other hand, very soft brushes, as of badger- or rabbit-hair, are inefficient and of little value. They possess no elasticity, and come in contact with but little of the surface of each tooth, leaving untouched such places as most need brushing. The same objection will apply to the use of the so-called felt brushes.

In manipulating the brush it is well to adopt some sort of system, and not permit few of the teeth to receive more than their share of attention, while others get little or none. Commence, for instance, with the very back teeth, and work gradually forward towards the centrals; then, with a somewhat quick movement of the wrist, give the brush an occasional semi-rotary motion in a direction *from* the gums. After finishing with one side, treat the

other side in the same manner. A suitable dentifrice is essential, which may be improved if the brush is passed across a cake of Castile soap before it receives the powder. On laying aside the brush the mouth should be thoroughly rinsed with water; and finally, some antiseptic agent like listerine, slightly diluted, if allowed to flow around the teeth, will prove beneficial. Such are the instructions given to my patients.

In closing, I must admit that our words of advice are sometimes like seed sown by the wayside, and we get almost discouraged when patients return to us, a few months after their teeth have been well treated, exhibiting sad proofs of negligence. Let us, however, be not weary in well-doing. If we do our part well, we at least have the satisfaction of feeling that we have been faithful to our trust.

DISCUSSION.

Dr. Fillebrown.—I heartily commend Dr. Francis's paper. It is upon a subject which, to be sure, is familiar, but one which gets much neglected at times. His instructions to his patients are very valuable.

I was glad to hear his mention of the use of iodine as a cleanser of the teeth. This use of iodine is not so general as it should be. I once advocated its use in an article and was criticised by *The Journal of the British Dental Association.* This past year one of my patients, whose teeth I have had the care of for many years, was in Europe, and called on one of our prominent American dentists there and had her teeth cleansed. During the process she asked him if he did not use iodine. "Why, no," said he; "it would ruin the teeth." The lady laughed and told him that she had had it used frequently and had yet to see any harm from it. I have proved that it is not injurious. I put a tooth in a bottle containing the tincture of iodine and allowed it to remain there for three or four months. I then removed the tooth and let it soak in water to remove the iodine, and then sawed the tooth completely in two. After soaking for nearly four months in the tincture of iodine, the tooth was just as sound and perfect as it ever was. If there is any member present who does not use iodine in the way described by Dr. Francis, I hope that he will try it at once, and advise his friends to do the same.

Dr. Andrews.—I wish to say that I have found it excellent in removing green stains. I am in the habit of using, also, peroxide of hydrogen together with the pumice and the iodine, and I think with those three materials you can meet any case.

Dr. Banfield.—Can any one tell me what compound forms in connection with this green stain?

Dr. Williams.—It has been known for some time that iodine, followed by ammonia, would take off nitrate of silver stains. I have forgotten just the chemical combination, but there is an accurate scientific reason for it.

I was much pleased with the paper; there were one or two points in it that I was particularly glad to hear mentioned. One of them was the fact of the dentist being blamed for more than he is responsible for. The essayist spoke of the importance of faithfulness in cleaning, etc., but how long do the cleansed teeth remain clean? I could not help recalling a case of old Dr. Joshua Tucker which he related some thirty years ago. He had put in some fillings and cleaned the teeth of a gentleman, leaving the mouth in very good condition. In the course of six months or a year the patient returned, and in looking his teeth over he found that one had decayed in an approximal cavity where he had placed a filling, and the patient began at once to blame him for not filling the tooth properly. The old doctor said to him, "The mischief started there and I stopped the decay; now it has started again in the same place and from exactly the same cause. Do you think I can do better than the Almighty?"

I always think of that when I hear dentists bemoaning so-called failures as if from lack of faithfulness in filling teeth, when, in many cases, it was from no fault of the operator, but came from just the same cause as produced the original decay. We should not always be blaming ourselves or others when we see mischief rampant.

In the matter of brushing, sometimes patients in their zeal to use the brush will get a tension on the lips and muscles of the mouth and face which prevents the free motion of the brush over all the teeth. I always tell them to let their muscles hang as lax as if they were going to sleep, and then they can get their brush anywhere, and will be likely to brush more thoroughly. I prefer a brush with fine but elastic bristles, not too closely set. This has the effect of a moderately soft brush, and not the harshness of a stiff brush. There is one great fundamental fact to be borne in mind in allowing children, or even adults, to use too stiff a brush, —they insensibly, if not consciously, avoid getting it near the gums. By using a softer one there is no danger of injuring the gums, and it can, with the proper motion, be used all over the teeth. The motion that I direct is a circular one, corresponding

nearly to the diameter of the teeth. In this way you get a continuous friction into the spaces and around the curves of the gum. I also recommend to patients the use of the rapier-pointed quill toothpick, not too stout, but so thin that it will soon soften in using. Of course there are spaces that you cannot get at with this, and you have to use floss silk. But I recommend this kind of quill because it is so well adapted to reach up under the gum. With the obtuse wooden toothpick you press material up into those crevices and keep it there.

Dr. Francis.—I have used borax successfully, especially in connection with inflamed gums, and in many cases of pyorrhœa alveolaris. It is an antacid, and, to a certain extent, an antiseptic. I direct patients to wet the tip of the brush, and pick up some of the borax with it and place it on the gums; wait a few seconds until the crystals are partially dissolved, and then whirl the brush without scratching the gums. The borax dissolves and penetrates the viscid material that lies directly at the necks of the teeth, and you can then brush it away.

Dr. Andrews.—There is one point that I did not quite catch. The essayist spoke of the iodide of zinc for congested gums. I should like to know a little more about this material and its action.

Dr. Francis.—Iodide of zinc is one of the best astringents that can be used in the mouth. It was first suggested to me by Dr. R. P. Lincoln, a New York specialist of throat and lung diseases. He told me that he applied it in throat troubles, and it occurred to me that it might prove effective as an application to inflamed gums. You can easily prepare the iodide of zinc. It is a combination of compound tincture of iodine and sulphate of zinc. The formula of the former may be found in the "United States Dispensatory." The sulphate of zinc should first be a saturated solution. They must be carefully combined, otherwise the iodine and zinc will both precipitate. Dilute the compound tincture one-quarter with alcohol, and dilute the solution of zinc three-quarters with water. Pour slowly, drop by drop, the solution of zinc into any given quantity of the solution of iodine until the iodine shows signs of precipitation. I use it much in cases of socket-disease, and find it an excellent preparation to inject into the pulp-canals of roots in treating alveolar abscess.

Dr. Williams.—I have had some experience with that material myself, using it with great benefit in some cases of pyorrhœa alveolaris.

Dr. Fillebrown's mention of the dentist who thought iodine

injurious reminded me of a similar experience that I had in relation to the use of borax. I had used it for some years, and a patient of mine, who understood its use, recommended it to a friend of hers. Afterwards that friend had occasion to go to her dentist and she mentioned, casually, that she had been using borax. "Why," said he, "you will ruin your teeth with borax." In November, 1889, I put some cuspid teeth in a bottle containing a saturated solution of borax. I looked at them yesterday, and the teeth were unchanged.

Dr. Clapp.—One of the best results of our meetings is in keeping us up to concert-pitch for our daily work. We cleanse teeth day after day, and I, for one, sometimes get tired of it. Certainly, if there is anything that needs doing thoroughly, it is the cleansing of teeth, and it is well for us often to consider this matter.

I use most of the methods Dr. Francis has spoken of, and in addition floss silk, and when I am not too tired I instruct patients how to use the silk themselves. Almost invariably the question asked by the patient while you are cleansing the teeth is, "How can I keep this tartar off my teeth?" I reply that I know of but one way, and that is by using floss silk. Then, giving the patient a mirror, I demonstrate its use. Another time for using floss silk is after using pumice. It removes all the particles of pumice and calculus that remain between the teeth, and leaves the mouth in a much more comfortable condition. The syringe will not remove all of the débris.

Another preparation that I have been in the habit of using in the place of iodine is a formula composed of tincture of iodine and glycerin, equal parts; to one ounce of this mixture add ten drops of carbolic acid (deliquesced crystals). I don't know that this will act quite as readily on the green stains as the plain tincture of iodine, but it is much less disagreeable to the patient, and it will act nearly as well. It is also remarkably adapted for congested and inflamed gums, and it is almost a specific for cracked lips. We have a large number of patients coming to us in the winter-time with cracked lips, and it is certainly a very painful and disagreeable trouble.

Dr. Francis has spoken of listerine. I would like to ask him if he fears anything from its acid nature. It has quite a strong acid reaction from the boracic acid contained in it. I am in the habit of using it, and in the mouths of patients who are troubled with what we call tartar I have recommended it freely.

Dr. Francis.—I believe that a single drop of milk, if left to ferment in the mouth over night, will work more mischief to the

teeth than could possibly result from a free use of listerine. I never like to advertise patent nostrums, but I have witnessed such excellent results from the use of this preparation that I feel impelled to refer to it favorably. I know of no other mouth-wash which has proved so reliable, and in some cases where I have found teeth in such a condition that I almost despaired of saving them, they have been kept well by the use of listerine. Some of the best-preserved teeth that I have seen are in the mouths of those who habitually use it.

It has been remarked that the application of iodine to the teeth is unpleasant to some persons; but not once in fifty times where I have used it has any such complaint been made. I have, however, in a number of instances, had patients speak of it as a "pleasant-tasting" application. It is invaluable when cleansing teeth for children, because it shows up the stains and renders them easy to remove.

Viewing the case either theoretically or practically, we need fear no harm from the use of either iodine or listerine in the mouth. If any person present has never tried iodine for cleansing teeth, I would advise him to do so. It will disclose stains not easily discovered without applying it.

President Brackett.—I remember a score of years ago, in my student days, it was my privilege and advantage to have some excellent instruction and advice upon the subject of cleansing teeth. I am sure it will gratify every one of us to hear Dr. Moffatt speak on this subject.

Dr. Moffatt.—The subject of the cleansing of patients' teeth by the dentist has always been one of great importance in any practice. I have always insisted that the dentist should put every one of his patients through a course of careful inspection for the cleansing of their teeth, some needing it once a year, some twice a year, others three or four times a year. When I held the chair of Operative Dentistry in the Harvard Dental School, I endeavored to instruct the students as well as I could upon the importance of this subject.

I had a system of cleansing the teeth and a set of suitable instruments for doing so. Commencing with the lower central incisors, I passed around on one side as far as the wisdom-tooth, then in the same way with the other side, and then proceeded to the upper ones, carefully inspecting every tooth, and getting it as nearly clean as possible.

Dr. Francis made one suggestion in his paper that I do not

quite agree with, and that is with regard to the free use of tepid water during the operation of cleansing the teeth. There is more or less bleeding at the time, but I think the use of so much water is a little injurious: it dilutes the fluids of the mouth too much, and also the blood. I generally get along as much as possible without it, allowing the patient to free the mouth with saliva. At the close of my cleansing, then I give a little tepid water and use a little tannin.

I quite agree with him in the use of iodine and of listerine. One thing that I have generally used in connection with listerine is a little glycerin.

Some one asked what was the combination produced by the use of iodine in removing stains. I think I can make that clear. These stains are usually produced by iron. By the application of iodine, we form the iodide of iron, which is soluble and easily removed by polishing.

The cleansing of patients' teeth is one of the most important duties of the dentist, and most dentists, I am afraid, shirk it a little. I always give patients a lecture on the use of the brush and floss silk, and to a business man I always recommend the use of little rubber rings, such as he is apt to use in his business; these will do the work nearly as well as floss silk.

President Brackett.—I have been noticing our worthy member from Salem taking notes. Perhaps he will give us the benefit of his ideas.

Dr. Meriam.—I like to make notes as I hear things.

Regarding the use of iodine, of course we know that it belongs with bromine and chlorine; all of the group have bleaching properties. I don't know who introduced it in dentistry; I found it in use at the Harvard Dental School in 1871.

Dr. Moffatt.—If Dr. Meriam will allow me, I think the credit of introducing it is due to Dr. Thos. B. Hitchcock.

Dr. Meriam.—Thank you. I think that should go on record.

There is one thing that should be noticed, and that is the care of children's teeth when they are too small to come to the dentist. The nurse who has the care of the children can take one tooth at a time and attend to it, whereas in our office it would be too much for the little one's patience, and we cannot afford the time. For that purpose the best thing to use is a piece of rattan, cut to a point like a pen. I think the use of rattan for cleansing teeth came from Dr. Williams, and I have now several hundred rods of it in my cellar that I use for gardening and other purposes. I think it can be had at almost any furniture-store.

Another thing that I like to use is elder piths. They can be bought in bunches and are soft as chamois skin, and little pieces can be used in the final polishing.

Following the pumice, we can use oxide of tin. That was formerly used a great deal, and I always keep some on hand. I get it from Metcalf's in the wholesale department, and if it is not in any ordinary chemist's list, you can get it by sending there.

The rapidity with which anything acts in the mouth should be remembered. Heat and moisture are the great factors in the germination of plant life, and as every growth in the mouth so far discovered has been vegetable, we should keep that in mind. If you will notice a glass of water standing in a room, you will see how quickly the sides of it become coated. You will also notice how quickly the spores of ferns will germinate in a hot-house, small ferns often coating the sides of pots. I have often thought that as spores of plant life develop so rapidly, how important is it that we should use mild alkalies in cutting or dissolving away the mucous coating which is so easily formed.

There is one thing to be remembered, however, and that is the increased power of dilute medicines in proportion to that of their powder form. If we are to use anything as a medicine, I prefer a solution; but if we want it as a polisher, then I would use powder. Two years ago I completely cured a case of erosion by the use of a wash. All the front teeth were being rapidly eroded. I recommended the use of alcohol, the instructions being to get a burning in the mouth twice a day. The object of this was to reach the mucous glands that were giving out acid, and to give them a stinging so as to change the character of the fluids.

Dr. Clapp.—I would like to speak of a different use of iodine, and ask if any one has ever employed it in this way. During the year 1869 I had the pleasure of being, for about six months, in the office of the late Dr. Coffin, in London, and in the excavation of cavities he always used iodine. When the cavity was partially excavated, he introduced in it a little of the tincture of iodine, thereby getting the same result which we get on the stains of the teeth when we use it for cleansing. He seemed to think that if there was anything remaining in the cavity that was devitalized it would be colored and detected at once. I don't think he ever excavated a cavity without employing it.

Dr. Williams.—Did he depend upon excavation to remove the stain of the iodine, or did he use something for that purpose?

Dr. Clapp.—Nothing more than water. As I understand it, iodine will not discolor sound dentine; the color remains only in the dead portion, which of course has to be excavated.

Dr. Meriam.—One thing I omitted to mention, and that was pine-sticks. An excellent way to get them is to use the unpainted pot-plant labels. They are made of soft pine, usually straight and clean, and I get perhaps five hundred of them for a small sum, from seedsmen.

Dr. Eames.—As a finisher to my operation of cleansing I have used, with great satisfaction, fine, antiseptic, warm spray, given with a good deal of force such as you can get with a compressed air-tank or the foot-bellows. This is like a searching wind and rain which finds access to otherwise inaccessible parts. This warm spray used with force seems to drive all particles from the neighborhood of the teeth. I have experimented with the hand-ball atomizer to get a spray which patients might use, but it does not give sufficient force to accomplish the object.

Dr. Smith.—The essayist spoke this evening of passing the brush over Castile soap before using tooth-powder. I have felt that the use of Castile soap was injurious in many mouths. I came to this conclusion from observation, and also find that Dr. Garretson speaks of soap as having a tendency to produce recession of the gums. I do not know of a case that has come to my notice of extreme sensitiveness about the necks of the teeth where the patient would not answer "Yes" to the question, "Do you use soap?" I have prohibited in those cases the use of soap, and in many the sensitiveness has entirely disappeared without any treatment whatever. Dr. Shaw, whom some of you know has experimented in that direction on his own teeth, says that if he uses a tooth-powder with the slightest trace of soap in it his teeth will soon become so sensitive that the drawing in of air will produce pain, and that by changing for a powder in which there is no soap present, and with no other treatment whatever, that sensitiveness entirely disappears. I believe that dentists recommend Castile soap altogether too freely.

Dr. Moffatt.—I have had patients ask me, "What makes my teeth look so yellow and dingy?" I reply, "If you will give up using soap and get some powder that has a little friction, it will probably improve the appearance of your teeth." The fact is, that soap makes the mucous secretions of the mouth thick and heavy, and they stick to the teeth, and that covering is not readily removed by the brush, and so the teeth look dirty. The idea of

using soap is apparently a very good one, but in the mouth it doesn't work well.

Dr. Andrews.—I have found the same trouble with soap that Dr. Smith speaks of: it is likely to produce recession of the gums.

Dr. Williams.—You can over-stimulate the gums and make them recede by too much brushing. In regard to the discoloration of the teeth referred to, you cannot keep them white unless you use some powder with the soap. The soap acts as a lubricator for the brush.

Dr. Harris.—I would like to hear a few words on this subject from Dr. Stanton, President of the Harvard Odontological Society.

Dr. Stanton.—The subject has been so fully discussed that I cannot add to what has already been said. Dr. Andrews spoke of the use of peroxide of hydrogen as one of materials which he uses. I would like to ask if he has noticed any effect from the hydrochloric acid in the peroxide of hydrogen. As I understand it, in the manufacture of peroxide of hydrogen the makers are obliged to acidulate the water with a small quantity of hydrochloric acid. My attention was called to the matter by one of my patients, who asked if I thought it injurious for her daughter to gargle her throat with peroxide of hydrogen. The child's teeth were not in very good condition around the margins of the gum, and I suggested that she bring me a small quantity of what she was using. She did so, and I tested it. It surely contained a small quantity of acid, although it was a difficult thing for me to get an acid reaction. As an experiment, I then tested some of Marchand's, such as we get from the stores, and I found that it was very strongly acid, and it occurred to me that in children's teeth, where they were disposed to decay around the margins of the gum, it might possibly be injurious.

Dr. Andrews.—I was cautioned in the use of peroxide of hydrogen by what Dr. Rollins said in regard to it. I have used it with care, and, as far as I can see, there has been no injurious action as a result.

As to listerine, one can see how very acid it is when they test it. It turns blue litmus-paper red, and I have been cautious in recommending it, telling patients to use it no stronger than one-third listerine and two-thirds water. Recently I have been using phenol sodique a good deal instead of listerine, and I like it quite as well, or better. It is an antiseptic, and I use it for retarding the action and growth of germs in the mouth and teeth.

Dr. Meriam.—The use of these things is very general, and the

manufacture of them is closely followed up by the various druggists, so that it is quite easy to obtain the various formulas for listerine, etc. It seems to me that the profession is getting numerous enough now to have a book of formulas, as some of the hospitals have, and it would seem as though we ought to have preparations made for us as we wish them, and see to it that they are not injurious. For instance, we could have a listerine possessing its present virtues with the acid left out.

The regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms on June 1, 1892, at 7.30 P.M., President Brackett in the chair.

The paper of the evening was read by Henry S. Chase, M.D., of St. Louis, Missouri; subject, "The Law of Heritage in Regard to the Teeth and Jaws."

THE LAW OF HERITAGE IN REGARD TO THE TEETH AND JAWS.

BY HENRY S. CHASE, M.D., D.D.S., ST. LOUIS, MO.

There should be perfect harmony between the human teeth and the human jaws. Natural evolution of a race would at last produce this condition.

Naturalism is only the last term of a series, the first of which were inharmonious, and the succeeding ones less and less so, by the elimination of individual beings from the continuous line of descent. The free breeding of human beings on an island, or in an isolated country, would at last terminate in harmony between teeth and jaws, for adaptations to environment would continuously proceed until a level of agreement had been reached.

Fifty years ago I lived among a savage tribe of Indians in the then Northwest Territory, and now the State of Iowa. These people were called "The Sacs and Foxes." Their teeth were white and "even;" they were not crowded.

The "Winnebagoes," who inhabited a near-by portion of this country, were often seen on the "neutral grounds," and their teeth also were observed to be perfect.

Naval expeditions for exploration of the islands of the world fifty and one hundred years ago, commanded by Cook and Wilkes, found the natives of the Pacific islands to possess perfect teeth as to beauty, soundness, and harmonious position in regard to each other and the jaws.

Why do the dentists of the United States find an entirely contrary condition in the patients whom they have to treat? It is because the American people are not a fixed breed. They are not yet Americanized.

Germans, Russians, Swedes, Polanders, Hungarians, Irish, Scotch, English, French, Italian, Spanish have divided their repro-

ductive life-germs with each other, and produced children which will in some future time evolve a grand race of human beings. But this universal crossing of breeds without reference to the law of heritage is confusing enough to the scientist, but an utter despair to the mere student of the "practice of dentistry."

The dentist who has studied the science of heritage sees crowded but undecayed teeth in the mouth of a tall and beautiful girl of twenty years.

"Has your father sound teeth?"

"Yes."

"Has your mother sound teeth?"

"Yes."

"Are the teeth of your father regular and not crowded?"

"Yes."

"Are the teeth of your mother regular and not crowded?"

"Yes."

"How, then, is it that your own teeth are so dreadfully crowded?"

"I don't know. I wish you to straighten them."

The dentist continues: "Please let me ask you some questions. Where were your parents born?"

"My father was a gentleman's game-keeper in Germany, and my mother was the daughter of a shop-keeper in Paris."

"Is your father a tall, large man?"

"Yes."

"How is it with your mother?"

"Oh, she is very *petite;* she is only up to papa's shoulder."

Now, the man of science understands this. The girl has inherited the "locomotive system" of the father and the "vital system" of the mother. *Consequently she has inherited the teeth of her father and the jaws of her mother.* The father's teeth are large, and so are his jaws, and so there is harmony. The mother's teeth and jaws are small, and so in harmonious proportions. The law of heritage compels the jaws to go with the vital system. It also compels the teeth to go with the locomotive system. Thus large teeth are liable to grow in small jaws and small teeth in large jaws. The "locomotive system" gives the height of a person, and the "vital system" gives the rotundity of the person, including thus the organs of nutrition. This young lady is tall because she has her father's locomotive system, and she is thin because she has her mother's vital system. It is impossible for this father and mother to have a *petite* grown-up child.

Now, if this young lady has a sister not like herself, this sister

will be just the opposite in conformation. For she will be short and rotund. She will have the height or "locomotive system" of her mother, and the rotundity or "vital system" of the father. Thus she ought to have small teeth in large jaws. On inquiry I found this to be true. "My sister has too much room for her teeth; her front teeth are too far apart." Further: "She is as short as my mother, but stouter." Further: "No, we do not look alike in form or feature, but we both look some like our parents, and it's funny." Now, you may see that if her mother had been short and stout, this young lady would have been of immense size,—"tall and big."

The dentists of America will, for a hundred or two years yet, have to deal with "irregularities," for hap-hazard marriages will still continue to take place, until the majority of people are educated in the law of resemblance and transmission of organizations. Nothing but "organization" is transmitted. There is no such thing as "blood" in breeds of beasts or humans. Either parent may give either the locomotive or the vital system. But one parent cannot give both systems. Each parent gives a defined half of the new being. Indeed, a definite half of himself or herself unite in the marriage of reproductive germ-cells to produce a child.

In the practical study of this subject we are confronted with "exceptions" to the law. If we had greater knowledge, discernment, perhaps we would understand that the "exceptions" are only seeming, and that an unseen factor is a part of the law of modification in "heritage." Perhaps "atavism" is the factor, recognizing by that word the persistent reproductive life-force from former generations.

The Indians of whom I have spoken were a pure breed of humans, *fixed* in their characteristics. Marriage out of their own tribe would only take one from the same family, and belonging to the same race. This is sufficient reason for harmony between their jaws and teeth.

This great family extended from the thirty-second to the forty-sixth degree, and from the Rocky Mountains east to the ocean.

DISCUSSION.

President Brackett.—The paper of Dr. Chase is before you for discussion. It certainly is a suggestive paper, and makes a broad study of a far-reaching law, and is perhaps quite as profitable in its place as one that considers details of daily practice.

Dr. Williams.—Heredity, in my opinion, may be held responsible not only for disproportion between the size of teeth and jaw, but also for strength or weakness of the tooth-substance.

I don't know whether Dr. Chase in his essay strictly meant that "blood did not tell." If he did, I should not agree with him. Heredity of qualities has been almost universally recognized.

Dr. Kinsman.—I have an interesting case, showing the development of teeth as affected by the law of heredity.

My wife and I are both without lateral incisors. I have two children,—a girl six years old, who had a perfect set of deciduous teeth, and is now beginning to erupt her second teeth, and a boy, who is minus the right superior deciduous lateral, his superior jaw being a perfect miniature of his father's. I had expected that in the permanent teeth there would be a lateral missing somewhere, but I did not look for its absence in the deciduous teeth. Of course it cannot be possible that he will have a permanent lateral on that side. In my wife's family I do not find anything missing in either of the parents, but every other child is minus the laterals. One aunt is minus the laterals, and retained her superior deciduous cuspids until over fifty years of age. Her superior wisdom-teeth were not erupted until after fifty years.

I came across a case recently of a young man of about twenty-five who had four laterals, two of them in the centre of the mouth directly back of the permanent centrals, one of the laterals so placed being considerably larger than either of those that were in position. We frequently meet with cases of one extra lateral, but I never before heard of a case showing two.

Dr. Williams.—I received a suggestion from a patient several years ago which, to his mind, seemed to be an explanation of the cause of the lack of the lateral incisors in his son's mouth.

The son was probably twenty-four at the time, and the father asked me if I thought he would ever erupt the laterals. "Probably not; sometimes they are omitted," I said. The gentleman, who had a stock-farm, said that in raising colts the lack of a tooth was thought to be an indication of high breeding. I told him that perhaps that might account for the omission in his son's case.

Dr. Andrews.—Some years ago, Dr. Cutter, of New Orleans, wrote an article in which he spoke of a colony of tailless cats which existed somewhere on the Mississippi River. He attributed their peculiar condition to the fact that a certain cat lost her tail, and henceforth bore tailless kittens.

Dr. Stevens.—In the State of Maine, where tailless cats exist,

they attribute their peculiarity to the fact of their being crossed with rabbits.

Dr. Williams.—Contraction of the jaws has been attributed by Dr. O. W. Holmes in part to lack of use, and in part to habits of hasty feeding. On this theory the sturdy Englishman who takes pleasure in chewing his beefsteak is likely to have an ample alveolar arch and a full complement of teeth. But where soft foods are largely used and the teeth are not needed in mastication, there is likely to be a deterioration in the quality of the teeth and lessening of their number.

Dr. Meriam.—Dr. Andrews's statement with regard to tailless cats reminds me of one of the curious things which are said about the breeding of rabbits. By crossing two breeds and breeding the offspring of this union to the offspring of two other distinct breeds, it is possible to obtain a rabbit which will hold a distinct strain. With regard to cats, you may have noticed that the ordinary tortoise-shell cat is always a female, and the buff cat is always a male, and they will hold to these colors, no matter how much they are bred.

Dr. Moffatt.—One of the most important suggestions made to-night is that data should be collected and kept in the museums of our societies, in order to form a basis for arriving at conclusions as to the subject under discussion. We need models of cases and full notes with reference to them.

Dr. Smith.—Irregularities of the deciduous teeth are rare. Dr. Talbot has, in his collection, two or three cases of supernumerary teeth in the deciduous set. I have, in my own collection, a case showing a supernumerary deciduous lateral. I have never read of or seen a case where the deciduous lateral was missing. It seems to be established that irregularities of the teeth are produced by a crossing of types and races. It is stated that in a pure race like the Chinese, Japanese, or North American Indian there are no irregularities. Such deformities are therefore in a sense the result of civilization.

Dr. Meriam.—I have in my care a little patient presenting a clear case of protrusion of the lower jaw. It is an irregularity of the deciduous teeth, and I have never seen such a case before. With regard to the matter of heredity, I can call to mind instances where the union of healthy parents has produced feeble offspring. We cannot quite say that the bringing together of certain people will furnish a definite result.

President Brackett.—There is much lack of definite views on the subject of heredity. To my mind marked peculiarities are at-

tained through a peculiar heredity and its cultivation. Given a certain line of ancestry, and peculiar characteristics can be developed. The confusion appears in many men's minds that surgical procedures are a matter of considerable consequence. To me they seem of little importance, except as they affect the use of a part. In the State of New Hampshire the farmers have, for many generations, cut off the tails of lambs, but as far as I know there have been no lambs born without tails.

The Jewish custom of circumcision is another case in point. The extraction of teeth has little, if any, influence upon the number of teeth to appear in succeeding generations. But when teeth are lacking through nature's operations, and people having such peculiarities intermarry, then a lack of teeth may be expected in their offspring.

PRESENTATION OF SPECIMENS.

President Brackett.—A gentleman, aged about thirty-five, came to me two months ago with these little specimens which I pass around. They have all the characteristics of calculus. The patient for about two years had been having trouble in the region of the left lower third molar, which tooth had never erupted. On examination several fistulæ were found on the inside of the mouth. There was considerable swelling and a profuse and offensive discharge. After injecting a solution of cocaine and carbolic acid I cut through the soft swollen tissues. A probe disclosed something feeling like a tooth. With this lever-like instrument I was able, without much difficulty, to bring to light this third molar. The crown of the tooth was incrusted with calculus, and hence the origin of the particles first passed around. After the operation, the affected parts returned to a healthy condition in reasonable time.

Dr. Andrews.—Dr. Charles H. Osgood, of this city, had a patient several years ago, who was frequently confined to his bed for two or three weeks on account of pain about the face. The best surgeons of Baltimore and Boston had failed to locate the cause of the trouble. Dr. Osgood suspected an unerupted wisdom tooth, and finally succeeded in extracting one which looked very much like the one which Dr. Brackett has shown to-night.

Dr. Stevens.—That brings to my mind the case of a young lady who was a patient of Dr. Charles Aspinwall, of Lynn, Mass. She had a sore on her face for which she had been treated by surgeons in vain for a long time. Dr. Aspinwall removed from her a wisdom tooth, extracting it from the outside through the cheek.

The regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms, on October 5, 1892, at 7.30 P.M., President Brackett in the chair.

Brief discussions were held upon the following subjects: "Banding Fractured Roots," and "Various Methods of Root-Filling."

DISCUSSION.

President Brackett.—In the absence of other suggestions, it appears in order to begin the discussion of "Banding Fractured Roots."

Dr. Banfield.—A patient presented herself to me a few days ago with an upper central which was loose, sore to touch, and had a discharge of pus from its socket. Upon examination and inquiry I found that the root was supporting a banded crown. It had become fractured some years ago, and had been banded in the hope of maintaining it as a useful member.

Considering it useless to attempt the treatment of a root in such a condition, I extracted it, and, to my surprise, found that the process of banding, instead of bringing the fractured parts more closely together, had forced the apex of the fracture against the alveolus. I will pass the specimen around, and you will see how the apex of the slivered portion has been carried out in forcing on the band.

The history of this tooth is this: At first a crown with a wooden pivot was adjusted, and after being worn for some years the end of the root had become weakened, until it finally fractured; then the root was banded, with the result which you see. I present this specimen to you to show how easily we may be deceived in similar operations.

In the treament of fractured roots, I first tie a ligature around the root, bringing the parts closely together; then make an application of compound tincture of benzoin to the inflamed gums, and wait twenty-four to forty-eight hours. As soon as the soreness has sufficiently subsided, I drill a small hole through the fractured portions of the root near the gum and insert a gold screw. If there is a filling, it is replaced with Weston's cement, and care is taken that the opposing tooth does not strike the fracture in the act of mastication. The ligature can then be removed. After the parts are held together awhile by the screw and cement, the inflammation ought to entirely subside. The crown or remaining portion can then be removed or so shaped as to receive a band or cap. This method applies

to fractures extending some distance above the gum. If, however, the fracture does not extend too far above the gum, I remove it, and, in fitting the band, cut it so as to completely enclose the space made by the removal of the fractured piece. I recall the case of a young man receiving a blow which fractured a central incisor; the fracture extended fully one-quarter of an inch above the gum on the palatal surface, and this space was completely covered with a portion of the gold band. This operation was performed some ten years ago, and to-day the parts are in a good and healthy condition, thus showing that the gum-tissue will in many cases admit of the band when properly adjusted.

Dr. Allen.—While listening to the remarks of Dr. Banfield, and especially in examining the specimen he presents, I could not help being convinced of the fact that it is almost impossible to tell when we have really succeeded in banding a root after the method described, and that a post-mortem examination is the only means we have of determining the result.

I remember a similar case,—that of a lady who, for a number of years, had worn an ordinary crown tooth with a metal post on an upper central incisor. An incautious use of the tooth had split the root, causing inflammation of the socket and loosening of the crown. My treatment consisted in cleansing the parts and banding the fractured portions of the roots firmly together, according to the method just described; after which I reset the crown with oxyphosphate cement, and while the condition, generally, was greatly improved, and has so remained, I do not feel certain that the fractured parts are in correct apposition.

Another case, though somewhat different, was that of a left superior first molar, the fracture extending through the crown, separating the buccal roots from the palatal. As usual in such cases, there was much inflammation, and pus was exuding from between the fractured surfaces. The treatment here consisted in tying a silk ligature around the crown, to hold the parts together, then drilling through the crown cavity, which extended to the pulp-chamber, and opening the canals as well as I could. The canals were found to have been previously filled with a solution of gutta-percha. I then enlarged the canal in the palatal root, and also the canal in the buccal root, and, taking a piece of irido-platinum wire, formed a little staple, which was fitted into the two roots, and which held them tightly together. This staple being cemented into place, the entire crown cavity was filled with oxyphosphate cement, after which I put a gold crown on the tooth. It is now three years

since that operation was performed, and the tooth is still doing excellent service.

In cases where roots are slightly fractured one-eighth inch or so beyond the margin of the gum, I remove the broken piece, and make a gold band with a broad flange, covering the edge of the root from which the other piece has been removed. I have also succeeded admirably, in cases where the root has decayed to a high point on one side, by widening the band at that point and then capping the band in the ordinary way.

Dr. Andrews.—I remember a case of fractured root which has something of interest in it. Before I went into my present office, nine years ago, a young man had an ordinary pivot tooth put on, which was held in with either cement or gutta-percha, I don't remember which. Soon after, he fractured the root. A band was made of platinum and the pivot tooth again inserted. The platinum not only went around the root, but also part way over the end of it. That held until nearly a year ago,—all of nine years, I should say. For some reason the tooth became loosened, and while I was away my associate reset it again with red gutta-percha. That held for about two or three months, then came out again, and upon looking at the band closely I came to the conclusion that pressure had enlarged it, as blood oozed from between the fractured parts when moved. I took off the platinum casing or band, and with wire brought the parts closely together.

The fracture seemed to be from the front, running nearly down to the apex of the root. I then made another band, this time of gold, with a lip wider in front, to go upon the root, fitted it in as accurately as I could and burnished into place. Before putting it on, however, I dried out the root thoroughly, using gum sandarac, and put the tooth on with oxyphosphate. The tooth, apparently, is working very well.

Dr. Stevens.—In examining the tooth that Dr. Banfield passed around, it looks to me as if the fracture may have been caused by the insertion of the pivot rather than by the drawing in of the band.

Dr. Banfield.—I can't say in regard to that. It may have been decayed to such an extent that it could not be brought together.

Dr. Grant.—It seems to me that the tooth presents about the same features that any fractured root would, and I never believed it possible for any one to bring the two parts of a fractured incisor together and make a joint. The very thing which shows in this specimen is the very thing I should expect,—by pushing on an

inclined plane the point of the fracture is thrown off. I have always in such cases cut the fractured part off at once. If it seemed to be short enough, and if the upper edge of the fracture could be reached by a lip on the band, I run the lip up there, and I have in one or two instances put a band on the end of the root and used it as a matrix, putting an amalgam filling in it, and then taking the band off. I am not a believer in bands in the front part of the mouth. I have yet to see the banded incisor root that did not become a defacement, particularly in people who have passed middle age. You may put them on young people and, if circumstances are favorable, and there is no tendency to recession of the gums, they do not show, but if the patient is over forty they are apt to show within a couple of years. I don't believe it is possible to repair the fracture of an incisor by trying to bring the pieces into apposition.

Dr. Banfield.—I would like to ask Dr. Grant, in a case of this kind, but with a clean fracture, how he would treat it except by putting on a band?

Dr. Grant.—I would take it out if I could.

Dr. Banfield.—Then you would have to extract the root.

Dr. Grant.—That's just what happened there. All things which are possible are not desirable. If such a root as has been described is banded or repaired, as the dentist thought he repaired it, and the patient is tortured three or four years, I don't call that good dentistry. My idea of good dentistry is to do the very best that can be done, and not attempt impossible things.

Dr. Banfield.—To illustrate, we have an abscessed tooth, and by treating that tooth we can make it useful for from five to ten years. Now, will you extract a tooth because it may last only five years? The same principle holds in the case of the abscessed tooth and the fractured root.

Dr. Grant.—I don't agree with you. I think the chances of success are quite different. If you treat an abscessed tooth, you stand a fair chance of being successful, but in treating a fractured root you are almost sure to fail.

Dr. Banfield.—But the tooth which has been shown lasted four years. Here was this fracture which extended more than half-way up the root. Now, it seems to me that a band around a root of this kind, put on with a fair degree of skill, ought to hold the parts together securely and make a useful member. Suppose once in a while we do have a failure, it seems to me the successful operations will well repay us.

Dr. Williams.—I have a case of a left central incisor tooth which

has been split and banded, or "hooped," as I call it, and it has been doing good service for about ten years.

In regard to what is "good dentistry," my idea is that we must know not only what to do, but how to do it. If you think it is necessary to band a fractured root with a wide, heavy, thick hoop, or section of a barrel you might call it, you make a mistake. You often get sufficient hooping with a fine wire. It keeps the parts of the root together sufficiently well and is all that is needed. In fact, to put on a heavy gold hoop to keep fractured parts together seems to me about as practical as taking a windlass to wind a watch. If the split is long, I would invariably hoop it; if a short one, rarely.

Dr. Banfield.—It would be interesting to hear from Dr. Williams how he adjusts this wire and secures it in place.

Dr. Williams.—I first wind a fine wire around the tooth, and then adjust gold wire slightly tight, and, after soldering the ends together, spring it over just under the edge of the gum, so that the gum covers the wire. The root is of a sufficiently even size to hold the wire where it is, and the band stays in place by its own tension. The wire used is a non-elastic wire. When in place, there is not tension enough to strain it, and there is no chance of crowding the upper end of the tooth out, as was done in the case presented here to-night.

President Brackett.—If no one wishes to add to the very practical discussion that we have had on this subject, we will proceed to the other topic,—"Various Methods of Root-Filling."

Dr. Allen.—Root-filling is a matter that I have given especial attention to ever since I began dentistry. I think I have tried nearly all the methods, but, in the main, have adhered to one, and that is the use of oxychloride of zinc. I have not used it invariably, but consider it the best root-filling, and especially in cases of putrescent root-canals. I don't think I have had trouble in more than two per cent. of the cases that I have thus treated, and where I have had trouble I attributed it more to a faulty operation than to the method employed. To overcome the difficulty of sealing the apical foramen, I employ this method. Assuming that the pulp-canal has been thoroughly cleansed, and ventilated for a sufficient length of time to get rid of the products of decomposition, I dry it out with hot air. This is accomplished by taking an ordinary chip-blower and drawing the air through the alcohol- or gas-flame, and inserting the point of the tube into the pulp-canal, compressing the bulb at the same time, and then allowing the bulb to expand to

draw the air out again. In that way I get my canals very dry, and if I think there is likely to be trouble in getting the creamy oxychloride of zinc up to the apex, I take a piece of orange- or cedar-wood, a little smaller than the nerve-canal, and, after working in as much of the oxychloride as I can with the Donaldson nerve-broach, take the splinter of wood and drive it as far up as possible, and there leave it. I never make provision for opening a canal after having filled it; experience teaches me that it is unnecessary. If the root should afterwards give trouble, which very rarely happens, I know at once that I have not been thorough in the preliminary details.

I have opened a good many canals that have been filled with gutta-percha, and in a great many instances there has been considerable odor, and in some cases the gutta-percha itself has been in a putrescent condition. But in opening canals filled with the oxychloride of zinc, I have noticed an absence of odor, and believe that this substance renders inert any portion of decay that may have eluded my efforts to remove it. Of course, there are many methods of filling canals where the tooth has been devitalized and the pulp immediately removed, but I am speaking particularly of *putrescent* canals and my experience with oxychloride of zinc in such cases.

President Brackett.—The chair would like to clearly understand whether the last speaker feels justified in introducing this root-filling before the odor from the canal has disappeared, and before there is evidence of a general state of health of the investment of the root.

Dr. Allen.—I never introduce any root-filling until I have made myself reasonably sure that all products of decomposition have been removed. My method is to be as thorough in the first cleansing as possible, using peroxide of hydrogen to a large extent, and hook broaches and other canal cleaners to get out all the loose decayed substance. Then I leave a dressing within the root for from three to five days, saturated sometimes with carbolic acid, sometimes with nothing but peroxide of hydrogen, occasionally listerine, according to the amount of putrescence present. I find that I have occasion to depend less and less on these substances according as I am thorough in the removal of the decay.

I continue this treatment as long as the odor persists, and when there is an absence of odor, I proceed to fill the canal.

Dr. Andrews.—My method of treating these canals I suppose is the same as used by many others. I do not believe in over-treat-

ment. My aim is to cleanse the canal as thoroughly as possible. I seldom treat more than three times.

I find a very excellent antiseptic to use is a mixture of oil of cassia, oil of wintergreen, and carbolic acid, combined according to the formula of Dr. Black. I don't remember the proportions. In filling the roots I use chloro-percha, or liquid gutta-percha, and gutta-percha in the form of points, usually oxyphosphate over that, as I seldom fill the tooth permanently at this time. The filling is allowed to remain for six months or a year before permanently filling the tooth.

Another matter I wish to speak about is this: Dr. Stanton, president of the Harvard Odontological Society, spoke to me of his success in using oil of cassia combined with iodoform, and stated that he had had several difficult cases of abscessed teeth which he had succeeded in curing by this treatment.

Some time after this, speaking to a friend who is a druggist, I asked him if oil of cassia and iodoform could not be combined with some medium to make it dense enough to be rolled into points, like gutta-percha points. He thought it could be done, and, after experimenting, he made some for me, which I have used in several troublesome cases with good success. How long it will be before they dissolve, or, if they ever do, I cannot tell.

The gutta-percha points, when carefully manipulated, are so well adapted for pulp-canal fillings that I should be loath to give them up.

Dr. Eddy.—I should like to ask Dr. Andrews whether he attributes the good properties of that mixture to the oil of cassia or to the iodoform?

Dr. Andrews.—To the oil of cassia.

Dr. Eddy.—Then why not use some antiseptic like hydronaphthol, and be free from the objectionable odor of iodoform?

Dr. Stevens.—I use tannic acid and creosote in root-canals, and seldom have failures.

Dr. Eddy.—I don't see why the dentist should tolerate in his office the odors from the old-fashioned antiseptics, and neither do I see why it is necessary that he should require a number of sittings to treat and fill a root-canal.

A lady came to me the other day with a second left inferior bicuspid that was very much inflamed. The crown and distal surfaces were filled with gold. There was an abscess pointing to the lingual side. I lanced the abscess, removed the dead pulp, and cleansed the canal, forcing peroxide of hydrogen through the fistulous opening. Redrying the canal, I forced a solution of chloro-

percha and oil of cassia through the tract. Inflammation soon subsided, and the patient has had no trouble.

Dr. Stevens.—I suppose the gentlemen referred to me when he spoke about the odor from old-fashioned antiseptics. If you put tannic acid and creosote together, you get no odor from them to permeate the office.

Dr. Eddy.—I did not refer to any one in particular, but you cannot cover those odors so they will not be noticed. We may not observe it ourselves, but there is an accumulation of odors that the patients notice.

Dr. Williams.—I remember Dr. Charles S. Tomes, some years ago, mentioned that, in opening a tooth in which the pulp had been dead for some time, he always kept it bathed in eucalyptus oil, which at one time had quite a reputation as an antiseptic. If we needed a stronger antiseptic, we might combine the oil of cassia with the eucalyptus oil. There are so many nice things in the list of antiseptics now, that it would seem to be very easy to make a selection.

Dr. Andrews.—I used iodoform experimentally. It was recommended highly, and I wanted to see if it worked right in my cases.

I remember reading about a dentist who used a mixture of one-half arsenic and one-half oxyphosphate of zinc, and filled the root-canals with it, and stated he could cure any case no matter how bad.

Dr. Allen.—I think the discussion has brought out some points that I should like to try, such, for instance, as the essential oils, with which I have but little experience.

Dr. Andrews.—I sometimes find that, after drying the canals, there is apt to be still a little moisture at the apex. I find traces of it on the cotton used.

Dr. Allen.—I think the solution of oxychloride of zinc overcomes that, as it acts as a cauterant.

The regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms on December 7, 1892, at 7.30 P.M., President Brackett in the chair.

The paper of the evening was read by Dr. James A. Reilly; subject, "Unnecessary Pain in Dental Operations."

UNNECESSARY PAIN IN DENTAL OPERATIONS.

BY JAMES A. REILLY, D.M.D.

It is not my intention this evening to attack any established theories or to attempt to overthrow any cherished opinions or prejudices. I simply desire to call your attention to a few points in every-day practice, and would prefer to suggest a few things you ought not to do rather than those you should do. Indeed, I am to address you from the stand-point of a patient in the chair rather than as the operator at its side.

One forenoon during my senior year at the Harvard Dental School, and while in charge of the dental department of the Bennet Street Dispensary, among the numerous patients was a lad of twelve or thirteen years. He went through the usual preliminaries required in order to have an inferior bicuspid tooth extracted. The operator mechanically picked up his mirror and pliers to examine the tooth, or what remained of it, and almost simultaneously with their introduction into the boy's mouth there was a terrific scream and a plunge that almost carried him through the window. An attempt at extraction by a street dentist had resulted in the removal of the crown, leaving the entire coronal portion of the pulp standing unprotected. The dentist simply plunged his pliers into the mass of living tissue. Was not that an abuse utterly reprehensible on his part? I think it was, and so would you, I believe, had you been the sufferer. Yet we are doing just such things every day in one form or another.

That "familiarity breeds contempt" is nowhere more noticeable than in the use of dental instruments and appliances. Not long since, a gentleman somewhat prominent in dental organizations told me he had not a dozen excavators in his possession; that he excavated all his cavities with the aid of the dental engine, and wished to wager me that I could not find a cavity in a tooth that he could not reach and prepare as well, if not better, with the engine than it could be accomplished with hand-excavators. Upon

being questioned if his patients did not complain of being hurt, he replied, "Confound the patients! my duty is to protect myself." If this gentleman could but be patient and operator at the same time, I have no doubt that he would be easily induced to trade some of his burrs for hand-excavators. Has he not, to say the least, become too "familiar" with his engine? This I consider an extreme case of abuse, for, allowing for a moment that all cavities may be reached (which I do not believe, unless he destroys a vast quantity of sound tooth-substance), the time that is gained by its use is but a trifling compensation for the torture that is thus inflicted on children and excessively nervous adults, and I suppose he has such patients. He may run his engine slowly, use the sharpest burrs and all the obtundents at his command, but does he diminish the loss of tooth-structure thereby, or reduce the inherent antipathy to dental operations which the average patient has? Does he not absolutely destroy the last vestige of confidence the little one may possess who has been beguiled into the chair by its parent with the unqualified assurance that "it will not hurt a bit"?

Another appurtenance, no less barbarous in some of the details than the untimely use of the dental engine, is the rubber dam. A prominent writer says, if it is at all difficult to apply, the rubber dam should not be used in the cases of the very young, very sensitive, or very nervous patients. How many of us draw the line at these classes? It is not my intention to point out the occasions for its use or to urge upon you its abandonment, for I consider it a *sine qua non* to good results in numberless cases. But I would like to call your attention to the contempt for your patients' feelings that a "familiarity" with its application breeds.

You are all aware how quickly you jerk your head away if by accident the floss slips too rapidly between your own teeth and burrows itself in your gums while you are cleansing them. How often the same thing is perpetuated on your patients, and nothing thought of it, by you at least, while you are laying coil after coil of cable on teeth that oftentimes do not require ligatures! Frequently, indeed, they serve only to obstruct access to the cavity. We all know, or should know, that with holes of proper size and shape in the dam the employment of ligatures is necessary only in a limited number of cases, provided the tartar has been removed from about the margins of the gum. But for pure, unalloyed torture, permit me to present to your consideration a clamp and an awkward or heavy-handed operator, and I think there are a few such in the profession.

I speak from experience, for it once fell to my lot to sit in the chair with a clamp on an inferior wisdom-tooth, compelling me to keep open house during the space of three and one-half hours. My knowledge now teaches me that it was entirely unnecessary, and that the cavity might have been filled, with the aid of napkins, in less time than it took to get the rubber and clamp adjusted, and with infinitely less pain and discomfort.

Now, I do not maintain that the clamp should be relegated into "innocuous desuetude," but I do say that extreme care should be exercised in selecting the proper ones to be used in each particular case, so that they may be easily adjusted, and that the most delicate and extreme accuracy of manipulation possible be employed while placing them upon the teeth. I know of nothing more repellant to the average patient than the rubber dam and its accompaniments; therefore I think it behooves us to manifest a little compassion by dispensing with the use of the clamp, or the ligature, and even the dam itself, whenever it is practicable.

Another medium for pain-culture, and one which gives ample opportunity for the application of all the reserve abuse we may have stored away, is obtained during a course of regulating. A great deal of pain and soreness of course, it is needless for me to say, is unavoidable while moving the teeth about, but there is also a large amount carelessly inflicted by over-anxious operators, too eager to accomplish in one day what should take a week, and again, doing to-day what they must undo to-morrow.

I once saw a case of regulating that was worthy of the attention of the society for the suppression of cruelty to children. The teeth were very much displaced, and appliances were adjusted to almost all the teeth simultaneously. Too much force was applied, and too long an interval allowed to elapse before changing, so that when I saw the mouth there was scarcely a tooth in the superior maxilla that could not have been easily removed with the fingers. For articulation the patient could not bring the teeth together without suffering intense pain. And all this under the direction of a reputed skilful operator. The effect of such operations is most pernicious, for the impression they produce on the patient's mind is often more enduring than what they effect in the physiognomy, and frequently nothing short of an exposed pulp will permit further dental operations during those years when the closest scrutiny and care should be exercised.

This, then, is the point I wish to make regarding the lack of care to avoid pain during regulating: that oftentimes nothing is

gained by the operation, because if you succeed in holding your young patient's interest to a successful termination of the work you have also generated mentally such an intense dread and abhorrence of you and your benefactions, that it is not until caries has obtained a firm foothold, and sometimes even demolished that which for months engaged all your energies to perfect and beautify, that your ministrations are again solicited. Would it not be more preferable to "make haste more slowly," and retain the confidence of the little ones, even at the cost of not accomplishing quite as much as you would wish to do at that time? This same principle is equally applicable to the filling of young teeth, and I frequently do nothing more at the first sitting than to cleanse a few teeth with the stick, or wipe out a cavity with an antiseptic and insert a little gutta-percha or cement, sometimes without removing any decay whatever. For I consider my time well employed if I can succeed in dispelling this dread which always possesses them at the first sitting.

There are many minor things in our routine work that might be dilated upon in a paper of this kind which are really painful, although to us they seem very trifling, and if our patients shrink from them we are prone to ascribe it to fear or timidity, when we really are inflicting pain. By the habits of some dentists one would suppose the patient had no rights that the dentist should respect. He lolls over and leans on his patient, making of his head a cushion and support for his arm till the patient is well-nigh exhausted. It does not diminish the discomfort any to know that it is sometimes done unconsciously. That much inconvenience and unnecessary pain are caused by our neglect to scrutinize our processes and individual peculiarities, or by failure to keep them before our eyes, is not to be denied. Is not unnecessary pain frequently caused while putting on gold caps, bridges, and collars for crowns, without first applying cocaine to the gum margin? Is it not unnecessary pain to continue nibbling at an exposed pulp that had not wholly succumbed to the arsenious paste? I think you will agree with me that to catch the lip beneath the thumb while making it a fulcrum against the teeth is rather painful, and that to wash out a cavity with cold instead of tepid water may produce avoidable pain.

How common an experience it is to hear an outcry, or see a twitching of the head and body immediately upon using the chip-blower while excavating! It does not take place so much if we use warm air. Yet, do we always use it? Is it not positively abusive to whack away at a tooth for hours with the automatic mallet, when hand-pluggers might be used with so much more

comfort, at least during the first part of the filling? Is it not an abuse to inflict quick wedging as ordinarily performed? Is it not an abuse, in taking full impressions for artificial dentures, to overflow the plaster from your impression-cup into the throat of your patient, when a smaller quantity would produce a much better result by giving a more accurate impression, because the parts are not so likely to be disturbed by retching and coughing? Is it not abusive for a dentist having a strong, muscular hand, with a heavy touch and a vise-like grip, to rush and hurry through his work as if he were under the impulse of electricity? My observations lead me to believe that rapid operators hurt more than slow ones. I believe that after a fair rate of speed has been attained, any acceleration of it is obtained only at the expense of delicacy of touch and of the patient's nervous system.

The conclusions I drew from my experience as a patient was, that more pain and discomfort arose from outside influences, if I may so term them, than from the actual preparation of the tooth to be filled. It is within the ability of everybody to cultivate a delicacy of manipulation, if they do not naturally possess it, and delicate manipulation is a powerful factor in dispelling the dread so universal in the minds of the people relative to dentistry. As President Elliot said the other day at the meeting in behalf of Harvard's new dental school, "It is the dread of pain which makes people miserable."

DISCUSSION.

Dr. Brackett.—I heard a remark some years ago concerning a dental practitioner, that all his patients became his friends. If the remark were true, as I suppose it was, the dentist did not attain that end by disregard of such advice as Dr. Reilly has put before us. If there is no discussion of this paper, the next thing in order is the exhibition of models of a case of regulating with the appliances that were used by Dr. Smith.

Dr. Smith.—This case was treated in the Infirmary of the Harvard Dental School. The lateral incisors were crowded far inside the arch by the cuspids, and there might be a difference of opinion as to what teeth should be extracted. In this case I advised the student having charge of the operation to extract the first upper bicuspids. After that was done, an appliance was made to move the canines back into the places occupied by the first bicuspids. This appliance consisted of two Magill bands soldered together, and cemented to the bicuspid and molar on either side. On the

buccal side of these bands was attached a screw, while the palatal surface held a small hook. To this hook a strong ligature was fastened and passed around a Magill band, which had been cemented to the cuspids and thence to the screw. By turning the screw backward the ligature was tightened, and pressure brought to bear upon the cuspids, which were slowly brought to place. The next step was to cement Magill bands to the laterals. To these bands were attached screws and nuts, the screws extending outward through an opening in a bar, which reached from cuspid to central. This appliance brought the laterals into line.

Dr. Williams.—I simply want to say that I am very glad to see that one principle has become generally recognized,—namely, that rest is as important as motion in cases of regulation.

President Brackett.—I understand Dr. Smith that the ligature used was silk. There was no elastic or rubber in any part of the appliance?

Dr. Smith.—No elastic or rubber. The screw is moved very gradually. I always caution students not to go too fast. You cannot move a tooth as you would a building on the street. With so much power one must be careful. I had a student bring out a lateral incisor from inside the arch in four days. It simply shows what a student will do if left alone with such an appliance. You can move a tooth more rapidly than you can produce absorption. Teeth should not be moved any faster than absorption takes place, unless the intention be to take advantage of the elasticity of the alveolar and spring it.

Dr. Fillebrown.—Here is the model of a case of bridge-work done some years ago. There are no Richmond crowns in connection with it. The work has proved both useful and durable to the wearer. The patient was about seventy years of age, a man of very nervous temperament, and his teeth were worn short and thin. He had lost an upper first and second molar on both sides, and wished to have something done to make his teeth more useful. The lost molars had to be supplied, and the bicuspids, being in poor condition, needed crowns. It was out of the question to grind the third molars for the fitting of caps around the margin of the gum. A way occurred to me, therefore, of making a cap and putting it on without grinding down the teeth. I first passed a band of pure gold, about number thirty, around the tooth, and towards the grinding surface added a second thickness of coin-gold. The pure gold was burnished to the tooth when the case was cemented on. The case has proved a very desirable and useful thing for my patient.

My confidence in bridge-work is strong, and has grown steadily from the first. I am glad to say that the first case I did, about 1880, has shown good service. It has never been taken off. I know of but few instances where I have had to make many repairs. I have had some failures, from decay of roots of teeth or from absorption of socket. In one or two cases the bridge-work has failed. Less than a half-dozen cases have made me any trouble.

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THE regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms on January 4, 1893, at 7.30 P.M., President Brackett in the chair.

The paper of the evening was read by Dr. J. E. Waitt; subject, "Anæsthesia, and the Use of a New Ether-Inhaler."

ANÆSTHESIA, AND THE USE OF A NEW ETHER-INHALER.

BY J. E. WAITT, D.M.D.

MR. PRESIDENT AND MEMBERS OF THE AMERICAN ACADEMY OF DENTAL SCIENCE,—It is with a feeling of diffidence that I come be fore you to-night to say a few words on a subject that ought to be familiar to each and every one of you, and yet, from personal observation and the special study of the subject for nearly ten years, I am confident that very few of us are perfectly at home in the use of ether, which, since its discovery and first introduction in 1846, has done more to alleviate the sufferings of humanity than all the other discoveries combined. It is a fitting tribute to Dr. Morton that I quote right here an abstract from an account of the "First Capital Operation under the Influence of Ether," by Daniel Dennison Slade, M.D., published in the October, 1892, *Scribner.*

Dr. Slade was present at the operation and graphically describes the scene. (Dr. W. T. G. Morton, referred to in the following article, was a Boston physician. He was the first to introduce the use of sulphuric ether, and his first experiment took place at the Massachusetts General Hospital, in October, 1846.)

"As all eyes were now fixed upon the scene before them, Dr. George Hayward stepped forward and remarked that, with the advice of the other surgeons, he should allow Dr. Morton to administer an article by inhalation to the patient upon whom he was about to operate which, it was alleged, would prevent any pain being felt.

"Thereupon, Morton, a man of commanding figure and appearance, very erect, and dressed, as he usually was, in a stylish fashion peculiar to himself, consisting of a blue frock-coat with brass buttons, a large and elegant scarf which completely filled up the open front of the waistcoat, 'gaiter' trousers, etc., and bearing in his hands the instrument already described, came from an adjacent room, and advancing to the operating-table, spoke a few words of

encouragement to the patient and instructed her in the method of inhaling. The curiosity on the part of all present was intense. The stillness was oppressive, broken only by the hurried respiration and occasional sob of the patient. Grouped about Morton, standing as the central figure at the head of the operating-table, were the surgical and medical officers of the institution, as also the attendants, all as intent upon the unusual scene before them as were the most untried spectators in the seats of the amphitheatre.

"In three minutes the patient was completely under the influence of the preparation, as shown by the complete muscular relaxation, the drooping eyelids, the immobile pupil, and the death-like insensibility to external impressions.

"The operation completed, and even before the removal of the patient from the room, the profound stillness and suspense which had hung over all present were broken by loud murmurs of surprise and admiration at the success which had been attained. Morton was the hero of the hour, and was regarded with feelings akin to those which might have been awakened had an angel appeared, bearing the waters from 'the Lethean streams of oblivion,' which having been administered to the suffering invalid, had produced the effects witnessed."

From that memorable Saturday, November 7, 1846, to the present day, there have been discussions as regards the best method of administering ether and the after-result upon the patient, especially after laparotomy, where it is positively necessary that the patient should recover quickly from the effects of the ether without the retching that so commonly follows.

To go over the different forms of apparatus for the administering of ether would take too long a time, but I can safely say that up to within a very short period there have been none devised but required a great amount of ether in their use and failed entirely in the three important factors of an inhaler as the medium in administering ether,—viz., rapid anæsthesia, anæsthesia easily retained, and by a minimum of ether; then a rapid recovery without its attendant evils, retching, sickness, and headache.

About five years ago I introduced an inhaler, called the Packard inhaler, to the medical and dental profession, which at that time, and even to-day, is the best form of inhaler that can be used in administering ether in the old way. I need not give a description of this, as I will pass one around, and you can see the advantages over the old towel or paper cones and that most miserable of all, the sponge.

In the new Packard inhaler which I present to you this evening you will see the result of many years' study and experimenting, and in it a means of safely, economically, and pleasantly administering ether. It involves an entirely new principle,—namely, anæsthesia with etherated air.

It comprises an ordinary face-piece, such as is in use with the gas apparatus of to-day; to that part which contains the shut-off is soldered a shoulder, for the attachment of a rubber sponge-bag, in the top of which is placed a slide-ring valve; through the side of the inhaler is passed a tube, with the inner end bent so as to enter the bag. A graduated bottle holding four ounces contains the ether. This bottle is fitted with a screw cap, which has fastened through the top two tubes, one passing to the bottom of the bottle and the other just entering the cap; each tube has a slip-joint so made that the rubber tubes which are fastened to them are securely held. An ordinary thermo-cautery bulb completes the inhaler.

Attaching the parts, as you will see, then compressing the bulb, air is driven through the ether, thereby becoming thoroughly etherated; this is then forced into the bag of the inhaler, and from thence to the patient.

This seems a complicated form, but by a practical test of but two or three inhalations you will see that it is very simple. The advantages are numerous. First, no ether comes in direct contact with the patient's face or skin, therefore all burning of the face and eyes is avoided. Secondly, as the ether vapor is wanted just so fast is it made, thereby saving all evaporation of ether and saturation of the surrounding atmosphere with its disagreeable fumes.

The results of over one hundred tabulated administrations show that the average amount of ether required to produce surgical anæsthesia was three drachms, and for each hour's consumption two ounces. The average time of inducing complete anæsthesia, five and one-half minutes; longest time, nine minutes; shortest time, two and one-half minutes.

The recovery is rapid, exceedingly so; many patients are conversing with the operator or nurse in three minutes after the inhaler is removed from the face.

Possibly a few words in regard to the best way of using the inhaler will clear away some doubts. This method I find the most satisfactory.

DIRECTIONS FOR USE.

1. Place from two to four ounces of ether, according to the estimated duration of the operation, in the bottle.

2. Place the hood over the patient's face, looking carefully to see that it fits air-tight about the chin and over the nose.

3. See that the air-valve on front of metal hood is wide open.

4. Compress the air-bulb very gently, just enough to drive a few bubbles of air through the ether.

5. At the end of the first minute close the air-valve.

6. Gradually increase the rapidity and force of the bulb compressions. One moderate compression with each inspiration is sufficient in the first stage.

7. As the patient approaches the second stage of anæsthesia, make two compressions of the bulb with each inspiration.

In from six to eight minutes the patient will be completely anæsthetized, with the consumption of from two to six drachms of ether.

During the progress of anæsthesia the air-valve can usually be kept partly open. At any time, in case of coughing, choking, or obstructed respiration, the air-valves should be partly or wholly opened.

Two and one-half ounces of ether should suffice for each hour of anæsthesia.

DON'TS.

Don't attempt to etherize a patient with the stomach full.

Don't use old ether which has stood in a warm closet or in an imperfectly-stoppered bottle.

Don't use anything but Squibb's four-ounce cases of ether.

Much of our success as anæsthetists depends upon our manner with our ether patients. We should see the patient a day or two before administering the ether, and in a quiet talk tell him of the peculiar features connected with its administration.

To be successful, circumstances must be brought under our control as much as possible, the patient in a submissive frame of mind, willing to yield entirely to us.

If a patient is frightened or roughly handled he naturally rebels, and the process is necessarily prolonged and therefore imperfect.

Children and adults of impressible natures are more easily overcome than patients of a vigorous intellectual character. Will may delay the progress of anæsthesia, and minds trained in reasoning will retain consciousness much longer than if less happily organized.

Ether should be administered three or four hours after meals, with the clothing in a loose condition at the neck and waist, and the patient in a recumbent position or nearly so.

In administering ether the eyes of the patient should be covered

at the beginning of the inhalation; this precaution shuts out external observation and hastens the period of insensibility.

It is also advantageous to have the attention of the patient diverted by counting slowly one, two, three, and so on, following the lead of the administrator. The expiratory effort by so doing is followed by corresponding inspiration, which assists materially the full inhalation of ether.

Few patients can count as high as twenty-five or thirty without feeling the effect of the agent, and scarcely any one can reach sixty or seventy before becoming unconscious.

The best tests for the proper period for operating are insensibility of the eyeball to the touch, non-contraction of the pupil on the sudden exposure to light, and the general muscular relaxation.

The ether may now be withheld or pushed to any desired extent.

The unconscious occupation of the mind by counting is far better than coaxing a patient to try and go to sleep, which, under the circumstances, is very difficult.

In administering ether the pulse and the breathing should be closely watched. If the pulse be strong, the patient is doing well; if it becomes feeble, the ether should be withdrawn and the access of air permitted. When mucus collects in the mouth and throat it must be removed at once by a wet sponge or by carrying the finger back of the retracted tongue and drawing it forward.

One more word and I am done, and that is concerning the after-treatment of our patients. They should never be left alone or unwatched until they have regained consciousness, or until the respiration, circulation, and color of the skin have been fairly established.

Frequently anæsthesia is followed by prolonged sleep, particularly in young patients. This may be overcome by bathing the face in cold water.

Fortunately, however, looking at the great number of cases in which ether is given with perfect impunity, accidents are very rare; so rare, in fact, that when they do occur it is a question whether they were the result of administering the ether or from some other cause.

DISCUSSION.

President Brackett.—With Dr. Waitt's co-operation, the subject is before you for discussion.

Dr. Stevens.—What do I understand becomes of the exhalations?

Dr. Waitt.—This valve being open, everything passes out here. In case it is desired to quickly force patients through the second

stage of anæsthesia, it may be done by closing the valve and compressing the bulb rapidly. Later, the valve can be opened again and the process carried on more slowly.

Dr. Eames.—I would like to ask Dr. Waitt if, in the rapid induction of anæsthesia which may be brought about by this special apparatus, he has noticed a disturbance in the circulation, indicated by blueness of the lips and face.

Dr. Waitt.—I have not seen a single case of it with this apparatus. You can guard against it by closing the valve and forcing a larger amount of ether vapor into the inhaler.

Dr. Fillebrown.—Do you mean that you can overcome cyanosis by giving more of that which produces it?

Dr. Waitt.—No. I take it that cyanosis is produced by the patient not getting the requisite amount of air with the ether. In this apparatus the amount of air can be increased without removing the inhaler or stopping the application of ether.

Dr. Fillebrown.—Then, in compressing the bulb slowly you have a larger percentage of ether vapor than you do when pumping fast?

Dr. Waitt.—Yes. There isn't time for the air to take up so much ether when it is being forced rapidly.

Dr. Fillebrown.—Do you know what percentage of ether the air takes up at the rate at which the bulb is ordinarily compressed?

Dr. Waitt.—I do not. Three cubic inches of air are forced through the ether with each compression of the bulb, but I could not say what percentage of ether is taken up, either at the regular or at the rapid rate of compression.

This rubber tube can be made long and the bulb placed under your foot, so that your hands will be free. This little hook is convenient for handling the bottle in hospital practice. The apparatus can also be fastened to the side of your chair.

The inhaler is the invention of Dr. Horace Packard, of this city, and can be obtained at Codman & Shurtleff's or at the Boston Dental Manufacturing Company. The present price is fifteen dollars, but they hope by getting out a greater number to make it less expensive.

Dr. Fillebrown.—I have had experience with this inhaler in one case, and I am very much pleased with its action, especially because it avoids the cyanosis which so often follows the ordinary method of giving ether. The patient with whom I tried this method I had previously anæsthetized in the common way, and cyanosis was very noticeable, so much so that we had to suspend the ether and resort to artificial respiration.

This inhaler has been in use for some time by the inventor, Dr. Horace Packard, but it has never been in the market until within two weeks.

In the operation referred to above, Dr. Batcheldor, who was accustomed to the use of the inhaler, kindly administered the anæsthetic. The operation was staphylorrhaphy, and the patient was under the influence of ether for nearly an hour and a half. I had to stop frequently to have her reanæsthetized, but there was no cyanosis, and she recovered quickly from the anæsthetic and without nausea.

I feel very favorably towards the apparatus, and think it worthy the attention of those who wish to give ether or chloroform.

Dr. Williams.—Speaking of cyanosis reminds me of a little story regarding an apparatus that was presented some years ago to give a supply of atmospheric air. At that time the matter of anæsthesia was not fully understood, and in taking gas the patient would breathe into a bag and inhale from the same over and over again. An apparatus was devised which had an inspiratory and an expiratory valve, of which a descriptive circular came to me. I called on a person named in the circular, and asked him what his experience was with the apparatus. He said, "he had tried it a week or so and it had not worked very well." I then asked him, "Do you notice in using it that you have any blueness of the face or lips?" He said, "No; but he thought it was best to blue them a little; they were not so apt to feel it!"

Dr. Banfield.—I would like to ask Dr. Waitt if he uses gas in extracting.

Dr. Waitt.—I probably administer ether twenty times to gas once. I only administer gas for extracting one or two teeth, or in some operation not requiring much time. My preference is to use ether, and ordinarily, by carrying a person to the second stage of anæsthesia with this apparatus, you can extract the whole upper set of teeth without replacing the inhaler. Of course, if the teeth break easily and you have to dig for the roots, you could not finish the operation with one application of ether. But you have the advantage in using this apparatus that you are not wasting ether all the time, and it is not being distributed about your office, nor does the ether come in contact with the patient's face. In the average case of extracting, about half an hour would elapse from the time you commenced administering the ether until the patient was ready to leave the office. Out of one hundred tabulated cases where this apparatus was used, there were but two or three where

any tendency to retching was observed, and those thus affected were etherized without paying attention to the time of eating.

Dr. Briggs.—I think this is a good thing. It secures a minimum amount of the drug and a proper admixture of air, and I don't think those two things have been so well combined in any apparatus before.

We have been accustomed to giving ether and chloroform in the most unscientific manner as compared with our care in the use of other drugs. We would not pour two or three ounces of laudanum into a man, and expect his system to absorb just enough of it and throw off the rest. That is practically what we have been doing in the old methods of giving ether, but here it is scientifically administered.

Dr. Moffatt.—I would like to ask Dr. Williams if he remembers the inhaler we used in Morton's time. I think Dr. Keep had one of them. It was rather bulky in construction, and the air entered only through the globe. Morton suggested that to force the anæsthesia you might plug up the orifice.

Dr. Williams.—He fixed it so you could "blue them a little." Yes, I remember it. He came near killing a classmate of mine with it; didn't give him air enough with the ether.

Dr. Waitt.—That was the original inhaler used by Morton.

Dr. Briggs.—I have been asked to supplement a paper on the use of cocaine in removing the pulp, which was read some time ago before the Academy. I will read you some of my cases treated last year.

The first case (January 2) happens to be the patient on whom I first tried the operation. Here was a tooth that had an exposed pulp which had been dressed with the desire to save it. The patient had neglected the tooth, and when she came to me again the pulp had become irritated, and I therefore injected cocaine, extracted the pulp, and filled the roots.

On January 14 I used this treatment on a sixth-year molar that I had been trying to save for six or seven years. The patient was a boy, and I had been waiting for the tooth to reach maturity so that I could put a cap on it. Having concluded that it had attained its full development, and that there was no need of longer keeping the pulp alive, I injected the cocaine, filled the roots, and prepared the tooth for a gold cap, which was put on a week later, and there has been no subsequent trouble.

The next case was a new patient, who came to me with an aching tooth from which she had been suffering for a week. I

found an exposure, injected cocaine, extracted the pulp, and filled the roots at the same sitting. There was no trouble afterwards.

As I pointed out in the paper I read, you do not really kill the tooth, you simply remove the pulp.

The next case was also a new patient, who came in with the tooth-ache. When she left my office the roots of that tooth were filled. So it goes on. Fifty cases of removal of the pulp in a year perhaps sounds startling, but the majority were in new patients, who came with the toothache, and I have finished with the troublesome tooth then and there.

I will not take up more of your time, except to mention one case that was particularly successful. The patient came complaining of toothache, which was so intense that I could not touch the side of his face on account of the pain. With a good deal of trouble I made an examination, and found an exposure in the lower right third molar where the pulp had hypertrophied. I found this old syringe-point with a trumpet-shaped opening, which just capped over the little enlargement of the pulp. I injected the cocaine and took the pulp out, and then told the patient what I had done. I do not tell the patients what I am doing until I am all through, because it might make them nervous.

One day, while operating for a lady, I found that there was an exposed pulp, and knowing the tendency to neuralgia when there was any trouble with her teeth, I injected cocaine into the exposure, removed the pulp, and filled the roots, and then told her about it. She expressed great astonishment, and said that I had not hurt her at all.

The idea is to have the point of the syringe cover the opening into the pulp-chamber, so as not to press the syringe into the pulp.

The solution that I use is a twenty-per-cent. aqueous solution.

Dr. Waitt.—Can't you get the same result with a ten-per-cent. solution?

Dr. Briggs.—I cannot get it with anything less than a twenty-per-cent.; and another very important thing is that it must be fresh. The solution is good for nothing when it is at all old.

Dr. Fillebrown.—How long does the anæesthesia persist?

Dr. Briggs.—Not very long; you have to work quickly.

Dr. Waitt.—How long after using cocaine do you begin to work?

Dr. Briggs.—I don't wait at all. I take the engine and go right to work. Sometimes I make a second injection, so as to make sure that there will be no pain.

Dr. Andrews.—I would like to ask Dr. Briggs what broach he uses.

Dr. Briggs.—Donaldson's.

Dr. H. F. Hamilton.—After a careful, thorough, and conservative practice of the method of removing pulps proposed by Dr. Briggs, extending over two and one-half years, I regard it not only as a pleasure, but a duty to report that I consider it the greatest advance in dentistry that has been made in many years. It is distinctly new and novel in its operation, and leaves the tooth in a healthier condition than when arsenic has been used.

All who have tried this method will, I am sure, agree with me in this statement. I have used it lately only in favorable places and conditions, with the rubber dam, and under such favorable conditions I have had uniformly successful results.

There are three ways in which one can fail:

1. The difficulty of access to the cavity rendering it impossible to force the cocaine into the pulp.

2. The use of old cocaine.

3. The non-ability to expose the pulp and properly apply the cocaine. This may come from lack of expertness in the operator or from nervousness of the patient.

The remedies for all such failures are apparent, and I see no reason why the operation should not take rank as a sure and safe one. By this method one can easily remove the pulp and fill the canal at one operation, and its rapidity and simplicity offer a relief from the necessity of capping many exposed pulps. I have, after watching many cases of my own capping, come to the conclusion that in most cases of patients of mature years, and in the teeth back of the cuspids, it is better to kill the pulp and fill at once.

I consider that a half-worn cement or gutta-percha filling, letting food in against the gum and allowing the teeth to crowd together as they may, a very bad condition, and sure to bring extreme disasters in its train.

Again, I think that we have not as yet realized the trials to patient and operator of calcifying and calcified pulps. Dr. Cooke has ably shown us how common they are, and all of us have realized their obscure and annoying symptoms, and the extreme difficulty of diagnosis and treatment. From my experience and from conversation with others, I am led to call your attention and ask your observation in regard to the extent of calcification of pulps under capped exposures.

I consider that in the majority of cases the capping of pulps is

merely inviting calcification, and where the conditions are favorable for injecting cocaine, I think it better practice to remove the pulp at once.

I wish to add a word of caution as to the use of twenty-per-cent. cocaine in the mouth. The rubber dam should always be applied, and if the tooth is decayed too far under the gum, a matrix should first be put on. In several cases where this could not be done I have sealed the cavity with soft oxyphosphate, applied the rubber dam, drilled into the pulp carefully on the buccal side near the gum, and injected the cocaine there. I then quickly removed the oxyphosphate and extracted the pulp through the cavity. A few breaths of ether will aid greatly in the drilling.

Dr. Williams—I came across an article in *Merck's Bulletin* for December, mentioning, as a new preparation, tropa-cocaine (or tropsin), which is an alkaloid recently isolated from a Java coca plant. Its advantages are:

1. It is less than half as toxic as cocaine.

2. Local anæsthesia, both of eye and skin, is much more quickly complete and is possibly of longer duration.

3. Its solutions are moderately antiseptic and retain their strength two or three months.

4. It anæsthetized in two minutes, and in one case in one-half a minute.

Dr. Hamilton.—I do not believe the members of the Academy realize the satisfaction to be obtained from this use of cocaine, and I advise you all to try it in the first favorable case.

Dr. Fillebrown.—Is there much hemorrhage?

Dr. Hamilton.—It is very slight; in some cases perhaps half a teaspoonful, and in other cases only a very slight quantity.

Dr. Fillebrown.—Not as much as when other agencies are used?

Dr. Hamilton.—Well, I don't know about that. I never tried any other agency for the extraction of a live pulp but once, and then I got only a piece of the pulp, but a great deal of experience.

Dr. Andrews.—I don't quite understand what is meant by the cocaine being forced in and around the pulp. Those of us who are familiar with the anatomical relation of the pulp to the dentine, as it appears under the microscope, know that it adheres to the walls of the tooth, and there is no chance for a fluid to get in between the two. I don't see in that case how you can "force it around the pulp."

Dr. Briggs.—I would not undertake to say that the cocaine is

actually forced around the pulp, but that is the apparent effect. I mean to say that the best result is obtained by forcing it onto the pulp rather than into it. If your syringe-point happens to push into the pulp, you do not get the same result.

Dr. Fillebrown.—Is not the pulp compressible, Dr. Andrews?

Dr. Andrews.—To a certain extent; but if you cut a cross-section of a live tooth, you will see that the odontoblasts of the pulp are very closely connected with the tooth-walls.

Dr. Fillebrown.—Perhaps under the force used those little fibres are severed, and that may be a source of the anæsthesia.

Dr. Grant.—It seems to me that the actual force required to break down that connection would simply have the same effect as a steel broach.

Dr. Fillebrown.—The difference would be that the steel broach goes into the pulp, while the cocaine may remain on the outside and yet force its way between the pulp and the tooth-wall.

The regular monthly meeting of the American Academy of Dental Science was held in the Boston Medical Library Association rooms, February 1, 1893, at 7.30 P.M. President Brackett in the chair.

President Brackett.—The subject of our meeting is "Crown- and Bridge-Work," and Dr. Moffatt will open the discussion.

DISCUSSION.

Dr. Moffatt.—It is not my purpose to present an elaborate treatise upon the subject of crown- and bridge-work.

The "American System of Dentistry" devotes nearly two hundred pages to this subject, presenting such a variety of methods that we find ourselves in a labyrinthian maze, and feel as if we were looking at a railroad map of the United States, with all the stations in capital letters.

Professor Litch commences his article by saying that for the systematic study of constructive details in tooth-crown and bridge-work, the model of an upper palatine arch, with two strongly-planted cuspid roots and two twelfth-year molar teeth or roots, may be taken as "a typical case." That may do for a study, but, in my opinion, it is far from being a typical case. It reminds me of the cut that was so profusely circulated in the New York daily papers some years ago. The public were invited to bring their mouths, with four such snags in them, and have a piece of permanent bridge-work inserted that would last forever.

Now, such ready-made cases may present themselves, and those who advertise in such a general way may be able to collect numerous cases of that type. But, in my experience, such typical cases are very rare in general practice. Each case that presents itself is *sui generis*, and must be studied by itself, and talent and skill exercised in its treatment.

No doubt Dr. Richmond has had as much experience as any or all of us, and it is very interesting and instructive to see him work in his own peculiar way. He has a great many little ideas that cannot be readily explained, and can only be understood by seeing him work. He has almost entirely abandoned the use of permanent bridge-work for large cases, using it only in small and limited areas, and, in my estimation, this is the best practice.

Bridge-work, as you all know, is not entirely the child of this generation. I was instructed in making bridges when I was a student, over thirty years ago. Bridge-work was done in those

times; but, of course, modern methods have greatly improved the operation and extended its employment to a greater number of cases.

Dr. Smith.—At the request of the chairman of the Executive Committee I present models of a case of crown- and bridge-work. Many of you, I think, have seen the case before, but you have probably forgotten it, and it may be new to you now.

This is a case of crown- and bridge-work, and also, in connection with it, contour-work with cohesive gold. This model, marked "forty-two A," represents the case as it came to me. The result of loss of molars and their wearing down, and also the wearing down of palatal surfaces of the incisors and cuspids, is evident. One cuspid was a pulpless tooth; the other was alive. The pulp of the latter was destroyed to facilitate the better adaptation of the bridge-work, and after the bridge was set, gold fillings were put into the cuspid teeth, and they were built up in the same way as the centrals.

This case was done eleven years ago, and I have never had any trouble with it, nor has the patient. It is the only extensive bridge case that I have done. I have always questioned the advisability of permanent bridge-work, but this case appeared to me at the time to be particularly adapted to it, and the operation was performed.

President Brackett.—It seems to the Chair always gratifying to hear with reference to any structures of this kind that have borne the test of time. That is one of several good points that Dr. Smith has brought out in his statement in regard to this case.

Dr. Banfield.—Recently I replaced a permanent bridge with a removable one. It was composed of two bicuspids and a molar. Caps were made for the molar and bicuspid roots, and cylinders with the bridge attached made to slip over the caps. If an accident should happen, I can slip off the bridge and repair at my leisure.

President Brackett.—The Chair would like to ask if this bridge-work is supposed to be removed by the patient.

Dr. Banfield.—No, sir; the cylinders fitted so closely I was obliged to file them, for fear they could not be removed after being adjusted to the mouth. Even now it will take considerable force to remove the bridge.

Dr. Meriam.—I have had almost no experience in this bridge-work, and, I am very thankful to say, quite a limited experience in crowning. But from what I have seen it has appeared to me that we depended too much on soft preparations of gold for the support of bridge-work, and that the tendency of gold to spread in wear is a very important cause of the failure of such work. If some of

the bridge-work was started with a little stiffer form of gold, there would of course be more trouble in fitting, but it would undoubtedly give better wear. The amount that a piece of twenty-two-carat gold will yield is considerable.

Dr. Moffatt.—I quite agree with Dr. Meriam that twenty-two-carat gold is too soft to use in many cases. I had a case recently which gave me considerable experience in that direction. The soft gold of which seamless bands are made had to be abandoned, and a stiff, heavy platinum clasp-plate used in its place. In a great many narrow bridges, where you want a very little plate, but still a very stiff appliance, a large flow of solder over a platinum and iridium wire, finished round or half-round, makes a very stiff and rigid plate.

Dr. Cooke.—I should like to ask to what extent the members have used crowns that are already prepared. The idea one gets from the cuts in the magazines is that all you have to do with ready-made crowns is to trim them up a little and press them into place.

Dr. Meriam.—I had in mind a crown put on by a neighbor of mine when I spoke about using soft gold. The band was easily spread, and was pressed into place so as fit the festoon of the gum beautifully; but it was soon found that the crown that was so easy for the dentist to spread and put on proved equally easy for the patient to spread and put off.

Dr. Allen.—I have attempted in two or three instances to use these ready-made crowns, but in each instance I have failed to secure satisfactory results, and have abandoned the attempt and finished the operation by making crowns in the usual way. I feel that I can work with better facility when making the crowns myself than by using ready-made ones.

Dr. Banfield.—Does Dr. Allen think that if these ready-made crowns were composed of eighteen- or twenty-carat gold, and of number thirty gauge, they would be of service?

Dr. Allen.—My trouble has not been with the yielding of the crown, but in adapting the band to the root and in getting the proper articulation. If I get the band over the root, I am not always sure of getting the crown in proper occlusion.

Dr. Grant.—Quite a little while ago I read an advertisement in one of the dental journals, in which some man—I think it was Dr. Land—claimed that he could attach amalgam or gold firmly to porcelain. I thought then that if he did it he must do it in some such way as the china painters put on gold in decorating. To see

if it could be done, I made a solution of gold in aqua regia and precipitated it, washed out the precipitate, and after drying it, made a flux with that and nitrate of bismuth, using plenty of gold. I then made several crowns and set them on molar roots with amalgam. The amalgam made an absolute union with the heavily-gilded surface. You can get enough gold on a tooth by this method so that it will hold amalgam firmly. There is no question but what it is an absolutely perfect joint. I intended afterwards to try borax as a flux, but I never did it.

Dr. Meriam.—I think the receipt-books all give an amalgam that will adhere to glass without difficulty, and I have thought that one of these days we would find a metal that would adhere to porcelain in the same way.

Dr. Cooke.—I would like to ask Dr. Grant if he relied on the union of the amalgam and the piece of porcelain to hold the crown.

Dr. Grant.—Oh, no. The object is to get a joint there; but by getting such a complete union between the amalgam and gold the tooth is made additionally strong. You cannot do it with decorators' gold, because there is not enough gold there; you have to make the flux yourself.

Dr. Cooke.—I am not quite satisfied with this discussion. I wanted to learn something about crown- and bridge-work, and I should like to find out what the members think is the best crown to use; and I wish, Mr. President, you would commence and ask each one separately what method is preferred.

Dr. Brackett.—Suppose we begin with you. What kind do you prefer?

Dr. Cooke.—I think a banded crown is the best one to use. Have the band go around the root and under the gum, and the pin inside set with cement. I prefer that to the crown that is simply held by the dowel.

Dr. Banfield.—If I were asked what was the best crown to use, I should be obliged to say, "It depends upon the case." At the present time I know of no one crown that would be well to use in all cases. In one I now have in mind, where the front teeth are short and very far apart, with sound roots, I cannot conceive of a kind of crown any more satisfactory than the all porcelain. A crown with any gold would look badly. I am soon to put on some crowns where the roots are weak and badly decayed at the labial surface, with recession of the gum. In such a case I would use a gold band to strengthen the roots.

The trouble I find with the Logan crown is that it is difficult to find one whose neck fits the surface of the roots; it is either too large or too small.

Dr. Preston.—I have nothing to say about crowns, Mr. President, but I brought a piece of bridge-work to show you, which I made July 29, 1839, and which was in use for nine years. I do not recollect that I ever did anything to the teeth until they were taken out. I made this without knowing anything about crowns, and it was intended to be permanently fixed in its place, being set in the roots with wood, and having gold pins in the two front roots. I put in a number of cases about the time at which this was done.

Dr. Moffatt.—Mr. President, I think that Dr. Preston more than bears me out in my statement that bridge-work is not a child of the present generation. Here is something that goes back over half a century.

Dr. Barker.—I believe Dr. Cooke's object was to bring out the preference of the different members for some special crown.

Probably practitioners will usually prefer that method which is to them the easiest. For a long time I used the Richmond crown pure and simple,—the band and the porcelain crown backed up and soldered to the band. I made and mounted numbers of them until Dr. Stowell, of Pittsfield, showed me in Montreal, a number of years ago, a method of his own. Since then I have mounted crowns according to the Stowell method. A description of his method can be found in the "American System of Dentistry." It is a simple banded crown, made by cutting off close to the porcelain the pin of a Logan crown, flowing pure gold around the pin, and soldering that bit of pure gold to a band which you have already fitted to the root. It is for me a simpler method and more certain than the Richmond, and is preferable, particularly in the case of front teeth, as nothing is seen excepting the porcelain.

One of the principal objections I find to the Richmond crown is that you cannot rely upon your colors, and in one or two cases I found it very annoying. With the Stowell method you do not have this difficulty.

For a simple pin crown I use the Logan entirely. I consider it strong and simple and satisfactory in all points, with the exception which Dr. Banfield spoke of,—the fact that the neck is often too narrow.

Dr. Bradley.—My experience in crowning, Mr. President, has been somewhat limited. I have used the Richmond crown for a

banded crown, mounting it with gutta-percha; but I use more of the Logan than I do of the Richmond, and I should say with considerable success. I have had a few roots split where a Logan crown was used, and also where the Richmond crown was used, though more rarely in the case of the latter. I use Dr. Evans's gold caps to a certain extent, and with what seems to me good success. There is one case which I would like to speak of. The patient was an officer in the army, who had nothing left of the right inferior first molar but two roots, and he asked me if I could not do something with them. The crown was entirely gone, and the roots were not even standing straight,—one of them laid over on the side. He said that food continually getting in these roots bothered him, but he did not want to have them taken out if it were possible to make any use of them. I took an impression of the roots in modelling composition and sent to Dr. Evans for two of his crowns, and after fitting them on, invested them in asbestos and plaster and soldered the two caps together and fitted them. The roots were not quite firm when I put the crown on, but they are a little firmer now. The gentleman says it is the best tooth he has in his mouth, and he gets a great deal of satisfaction from it. So far, I have been well satisfied with Dr. Evans's caps, and know of no case yet where there has been any difficulty in my use of them.

Dr. Grant.—I don't believe much in banded crowns. I have never had very good success with them. I don't think it is really necessary once in twenty cases to band a root. Of course I have seen a great many crowns that have been in use a number of years. I saw one not long ago that was put in by Dr. Moffatt over twenty years ago, before much banding was done. It was in the form of an ordinary pivot tooth, except the socket in the porcelain was of platinum, and there was a gold wire running through the wood pivot pin, but the joint was just as good when I saw it as it was when it was first made.

A most important feature in any crown is to be able to remove it. Of course every one knows that there is no porcelain crown that will not break, and when one does break, it is a tremendous job to take the pin out. It takes more time to get it out of the root than it does to put it on, if you want to save the root. A method of crowning that I sometimes employ is to take a piece of gold tubing, which is cut to a length equal to the depth of the root-canal. Drive a square cutting tool through the gold tubing, and make a perfectly plain-sided socket similar to that of a watch-key. This tube can be set in any way you prefer, and a square pin is

made to fit it. The tooth is soldered to this pin, and when the tooth, thus mounted, is placed in the socket, I have never known one of them to come out except by a straight pull. Of course they are liable to be broken, but new teeth can easily be put on.

Another plan is to bake a square or three cornered platinum pin in the old-fashioned pivot tooth. The pin can be secured firmly in the crown by a flux of powdered flint glass and borax. Continuous-gum body will answer, but the glass requires less heat.

In this way the relation of pin and crown are easily adjusted, while the result, in point of strength, is quite equal to that obtained by the Logan crown.

Dr. Meriam.—I would first, Mr. President, advocate the use of nitrate of silver in the treatment not only of the ends of the roots, but to a certain extent of root-canals, after preparing them for the pins.

Regarding a banded crown, if the joint is to be conspicuous I might not use one. For back teeth I should use the gold-band crown for men, and in all cases where the crown was to be subjected to severe use. For bicuspids I would prefer the English tube tooth. The colors are so good that I submit patiently to the annoyance of grinding them to a fit, and they are big enough at the necks of the teeth to cover the roots. The Howland crown seems to me a very valuable crown where there is room for it. It requires a certain depth of the crown to hold the pin, and that may be an objection; and another is that it has had no one to push it, but has depended entirely on its merits to bring it to prominent notice. It is only just now receiving the attention that it should.

For back teeth I prefer a crown that I can remove, and also prefer to use gutta-percha in the roots, except where the canal is large; then I use cement.

Dr. Stanton.—The subject of crowns has been so thoroughly covered that it seems almost impossible for one to add anything to it. My extensive experience, to which Dr. Smith has referred, has been more in the way of repairing other people's work than in doing new work. When I first began practice, a large number of patients who had had crown- and bridge-work done for them fell into my hands. I have, consequently, formed some very decided opinions with regard to crowns, simply from the results of the experience of others.

From a personal stand-point I think the only fit crown to use is one with a band on it. I have seen so many fractured roots and so much decomposition of the end of the root from loose joints

that I cannot but feel that the slightest play between the end of the crown and the root is fatal to the success of the operation. It does not matter how slight the movement may be, you are bound to have decomposition where it exists, and, strange as it may seem, it will follow the pin up into the root.

The recession of the gum and consequent showing of the band have been spoken of. I think a Richmond crown can be put on incisors without the band showing at all.

I do not think that the presence of the gold or platinum causes any recession whatever. I have seen banded teeth which have been in use for five to fifteen years, and, so far as I have been able to discover, the gums do not show the slightest indication of receding. If you put an all-porcelain crown on an incisor, you are dependent entirely on the pin for the strength of the tooth, and if there is heavy pressure brought to bear upon it, then either the porcelain crown will give way or the root will split. These results, of course, will reflect upon your skill and judgment. To my mind the lesser evil would be to put a band around such a root, even though it did show somewhat. But I have found, if a tooth is properly ground with a very thin corundum-disk, that you can carry the thin edge of the band under the gum in such a way that it does not show.

Supposing, however, that the band does show, it is infinitely more to your credit to use it, and have as a result a tooth that will last until the patient is obliged to lose his teeth from natural causes, than to endeavor to perform an æsthetic operation which will look well, but which is unreliable.

Cases of bridge-work come to grief from one of two causes: either decay will have progressed sufficiently to loosen the caps,—a process which is fatal to the whole bridge,—or there will be so much pressure brought to bear upon the supports that a tooth is pulled out. The latter condition may be found in removable bridges.

Dr. Smith.—I would like to ask Dr. Stanton whether, after considering the evils of both permanent and removable bridge-work, he believes in bridge-work of any kind.

Dr. Stanton.—That is a very difficult question to answer. Many cases of bridge-work are very successful. I know of an instance where a person has worn a full upper set and two partial bridges on the lower jaw for fifteen years, and they seem to be in as good condition to-day as when I first saw them. You will often meet with bridges supporting one-third to two-thirds of an upper or lower set which have been used for years and are still perfectly solid. On

the other hand, one out of the next half-dozen that you see will be loose from a cause which you will never learn, because it is impossible to obtain the history.

Bridge-work was very popular at one time, from the prevalent idea that loose teeth would be tightened by its use. There never was a greater fallacy in the world. One of the essentials for a successful bridge is to have firm foundations. Even then it is impossible to say that it will surely be a success. I never guarantee that a piece of bridge-work will last. Where bridge-work can be put in and the structure made light, a removable bridge is preferable to a permanent one. I have found it interesting to note how much some people will have bridges repaired before they will give them up; they seem to have an affection for them, and will pay enough in the way of repair to get a new appliance or an artificial plate.

Dr. Smith.—Dr. Banfield referred to a crown which he said I was very enthusiastic over. It is simply an idea of putting a hole in a crown, which I got from Dr. Perry, of New York. In the old-fashioned incisor pivot tooth the hole took such an angle that the tooth was made very weak. In case the tooth was ground for an occlusion, it became weaker still. Dr. Perry had some crowns made with the pivot hole pointing straight towards the cutting edge, and the result is a much stronger tooth.

No more artistic work in prosthetic dentistry can be done than to crown a root in the front of the mouth so that it will appear entirely natural. I had a case where I destroyed the pulps in the six front teeth and put on crowns. The method I used was to cut the labial portion of the root down under the margin of the gum and fit accurately a Perry crown. A platinum and iridium pin was set in the root-canal with gutta-percha, and then the crown set with cement. In doing this work crowns had to be carved for the case, and many had to be carved before satisfactory ones were obtained. While waiting for the carved teeth, ordinary teeth with very short holes were used.

In order to remove crowns set in gutta-percha, Dr. Payne, my associate, suggested the following plan: A small bottle was fitted with a cork, and through the cork a tube was passed. Through this tube a few threads of wicking were drawn, and thus an alcohol lamp was made which gave a miniature flame. This flame could be carried to the tooth, and sufficient heat applied so that it could be easily removed.

President Brackett.—Dr. M. W. Foster, of Baltimore, years ago, gave me an instrument which, in its use, bears a resemblance to the

miniature alcohol lamp that has been spoken of. It was made presumably of soft steel, with a handle of wood. The steel end had a deep V-shaped groove, and it was intended to be heated and slipped over the crowns to facilitate their setting in gutta-percha and their removal.

Another means of applying heat is by a continuous blast of hot air, produced by a syringe. With this a tooth and its setting may be made very hot.

Dr. Meriam.—Dr. Baycock sent me a little lamp of the same sort as Dr. Smith describes, except that it was made from a medicine-dropper instead of a bottle. It can be used as a small lamp for heating or as a flash lamp for cavities.

President Brackett.—It is hard to draw the line between this discussion and the demonstration of the use of a new furnace for porcelain fillings and crowns, by Dr. Bartlett. If Dr. Bartlett is ready, we should be glad to have him explain it to us.

Dr. S. R. Bartlett exhibited a small gas furnace, made by the Detroit Dental Manufacturing Company, designed for baking porcelain fillings and crowns. The muffle, which is made of platinum, is just large enough for one or two teeth, and has a platinum tray for holding the piece to be baked. Dr. Bartlett gave a demonstration of the use of this furnace by baking an incisor crown in just two minutes. The tooth used was an ordinary plain rubber tooth with iridio-platinum dowel held in position between the pins of the tooth, the band for the root being made of platinum with an investment of silex and plaster which surrounded the upper portion of the dowel and inner space of the band. The tooth thus invested was formed to the proper contour by Allan's continuous gum body, which covered the labial part of the band and was made continuous with the neck of the tooth. The crown was then baked; the time required for heating, baking, and cooling being about ten minutes. By this process of making crowns—which Dr. Bartlett does not claim as original—the objection to having the metal band show when the gum recedes is obviated.

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